



AGRICULTURAL RESEARCH INSTITUTE'

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THE
INDIAN FORESTER

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A Plantation of *Eucalyptus Globulus* at Ootacamund.

INDIAN FORESTER

JANUARY, 1905.

AN INDIAN BUREAU OF FORESTRY.

Cuilibet in sua arte perito credendum est.

I. GENERAL REMARKS.

IT has long been recognised by European Foresters that there is a large amount of special professional and scientific work to be carried out in connection with the proper care of the forests, and that this work cannot be performed by the officers engaged in ordinary executive duty ; this latter if it is to be done efficiently necessarily requiring all the time and energy at their disposal. In order to ensure that this special professional and scientific work shall be effectively undertaken a special branch exists in the forest services of the various European States, and such a one has been recently created in America. To this branch the name of Bureau of Forestry is usually applied, and the several specialists appointed for the work are accredited to it. The officers of this Bureau concern themselves with the operations in connection with the supervision, etc., of working plans ; with special investigations into (1) the reservation of any fresh areas required for climatic reasons and the preservation of the water supply ; the requirements of districts as yet containing no forest reserves, or regulated district or village forests ; with enquiries as to the best commercial trees to be found in the forests in different parts of the country, and as to the possibility of creating a demand for and putting on the market species for which there has been up to date no sale ; with general forest botany, the distribution of the various species, etc. ; the various diseases, insect and fungus, from which the forests suffer ; and, lastly, with the very important investigations into the possibilities of the various minor products of the forests from a revenue point of view.

We will consider shortly these various forms of enquiry and research together with their bearing and importance on the management of, and on the revenue to be derived from, the forest estate.

(a).—*The preparation and supervision of working plans.—*

i. *Sylviculture.*—The Working Plans Branch would make the study of sylviculture a special part of their work. During their tours the officers would make careful observations and notes on this subject in collaboration with the local Divisional Officers. The elaboration and publication of such notes would be of the very greatest utility to the local officers, since the department would soon have some useful and adequate data on the sylvicultural requirements of our various species, a subject upon which at present, we think that most officers will agree, available data are almost as absent as they were in the time of our predecessors, the forest pioneers of thirty years ago.

ii. *Working Plans proper.*—The supervision of existing working plans, enquiries into necessary deviations from such, checking draft plans, the preparation of notes for new plans, etc., would form the main part of the work of the Working Plans staff.

(b).—*Reports on afforested lands still not under reservation.—* Such areas would be carefully inspected and the requirements of the surrounding inhabitants and the extent of their dependence on local forests not under the management of the department would be fully considered. It is well known that such forests are rapidly disappearing, and that if left without proper supervision they will soon cease to exist. There are still such in districts never visited by a Forest Officer, and which, consequently, never fall within his province to report upon.

(c).—*A systematic record of all boundary work.*—This would be carefully drawn up and kept on record in the Bureau, where it would be readily available for easy reference.

(d).—*Measurements of rates of growth of the various species.*—A large series of Sample Plots of all the most important species would be established all over the country. All records of the

measurements made annually (or more often if considered necessary) would be kept in the Bureau. Two important objects would be gained thereby. The first that the measurements would be continuous and would be unaffected by the unavoidably constant changes in the *personnel* of the staff of the various divisions in which the plots existed, and secondly (and more important still) the available data would be all collected in one spot, thus enabling statistics to be compiled and issued for general information as their value and usefulness became apparent.

(e).—*Advice and preparation of simple working plans for private owners.*—This would be undertaken by the officers of the Bureau in all cases where it was apparent that it was of advantage to the State that such lands should be kept under forest. This question is of the first importance in mountainous regions and in hilly areas where the safety of the agricultural lands depends upon the hills being kept under forests.

(f).—*Grazing and fire-protection.*—The innumerable questions arising in connection with these important subjects would also engage the attention of the Working Plans staff.

III. GENERAL INVESTIGATIONS.

These can be divided into several very important sub-divisions

THE MAPPING OF TRACTS TO SHOW THE DISTRIBUTION OF THE MORE IMPORTANT TREES IN THE COUNTRY.

(1) Studies of various classes or kinds of forests in India with a view to the preparation of accurate maps of each tract showing the distribution of such forests in the country and the areas they occupy. Pamphlets with a map in each would be drawn up for circles and divisions.

COMMERCIAL TREES.

(2) The systematic study of the more abundant trees in India with a view to the introduction, either to local or home markets, of species at present not used. In this connection the more ornamental woods of the country should be carefully studied. Experiments on a commercial basis, i.e., such as would satisfy

commercial requirements, would be made with the woods with the object of placing them upon the market in such a manner as to ensure their meeting with success.

FOREST BOTANY.

(3) The distribution of the commercial trees would be accurately ascertained ; the portions of the country where they grow best or are in greatest abundance be found out, and their area definitely laid down on a map. A short monograph on each tree would be drawn up as soon as all possible information about it had been collected. In this the areas in which its growth is at present the best should be given as also those in which, from the evidence of old stumps, it is made evident that in former days its growth was exceptionally good. A list of associated trees should be always given at the end of the monograph. Each tree would be dealt with by itself, and at the end of the pamphlet a small map would be attached showing the distribution (*a*) as pure forest, (*b*) mixed forest.

FOREST ENTOMOLOGY.

The great importance of the thorough study of the life-histories of injurious insects has been recognised, and a special officer has been already appointed to deal with this branch.

MINOR PRODUCTS.

It will not, we think, be contended that one tithe of the minor products of the Indian forests are known from an economic point of view. That there are great possibilities in this direction is the opinion of those who have considered this question. It has become apparent, however, that little progress is possible until the department are enabled to take up the matter themselves. A special officer attached to the proposed Bureau would be in a position eminently favourable for dealing with this large and important (from a revenue-making point of view) subject.

WOOD AND BARK.

(4) *Tannings*.—Especial attention is required to be paid to the investigation of tannings with a view to placing them upon the

market. A question of this nature requires the specialist, the man who could devote his whole time to this and cognate subjects. The chemist would analyse all important products.

Wood pulps also require much attention. The forests of the country contain large amounts of at present unutilizable timber of inferior quality. It has proved impossible for a Divisional Officer to dispose of them, and yet he is aware that they would in all probability do very well for wood pulp, and would supply the whole of the coarser paper required in the country.

TREE-TAPPING.

Rubber—Turpentine.—Whilst the actual growing and tapping of plantations as, e.g., of rubber and of *P. longifolia*, etc., is the work of the Executive Officer, it would fall to the minor products specialist to find out about the best markets and the localities in which a certain produce is in most demand, etc. For instance, it is common knowledge that the difference in the prices of rubber is very great, varying with the species and the quality of the product obtained, both of which must depend to a great extent upon the nature of the soil, aspect, climate, elevation, etc. A specialist should be able to advise a local officer who was intending to put out rubber plantations on all these points. Again, competition amongst respective circles and divisions is undesirable. We believe that the industry in connection with the tapping of *P. longifolia* for turpentine was started in the School Circle and subsequently taken up in the Punjab, with the result that the latter Circle was able to cut out the former by underselling it. It would be the duty of the Bureau to see that this sort of thing did not occur, and that one part of a province did not expend money on undertaking a supply which could be done much more remuneratively in another.

OTHER MINOR PRODUCTS.

(5) *Myrabolans, grasses, canes, bamboos, gums.*—There can be little doubt that merchants at present suffer from not knowing what the forests contain and where articles can be obtained. Also, the commercial minor products of the country are by no means worked

up. We understand that in this connection Burma has now put on a special officer to deal with the subject. This is distinctly a step in the right direction.

A specialist of the Bureau would make this commercial aspect of the case his business. He would be acquainted with all the great firms, would know what things were in demand, whether others were likely to have a sale if placed on the market, would endeavour to create markets for new products by putting them on in such a condition that enterprising traders would soon come forward to take them up.

FORMATION OF PLANTATIONS.

(6) With the knowledge accumulated by the Botanical and Commercial Wood Specialist it would be possible for him to advise on the formation of valuable plantations in the country. A good commercial as well as sylvicultural knowledge of the value of the trees and whether a demand is likely to be maintained for their products is necessary before Government can be asked to make large outlays on plantations. An accurate knowledge of the means of communication in the country, the likelihood of feeder lines being built, mines opened (for which timber would be required), etc., etc., is necessary. Such knowledge, whilst being more or less of a sealed book to the local Divisional Officer, would be easily acquired by the specialist during his constant tours.

PUBLICATION OF RESULTS OBTAINED.

It is suggested that the best way of making immediately available to the department the results of the investigations of the Bureau would be to publish yearly Proceedings in which the information obtained by the various officers of the staff during the year would be collected together and issued. This would not preclude the same notes or information appearing again when sufficient data had been accumulated for the publication of a monograph on any particular forest tree or minor product. This is the procedure followed for some years by the Geological Survey, and which has now again, we understand, been revived under the present capable head of that department.

It may be said that this work would overlap with the Botanical Survey on the one hand and the Reporter on Economic Products on the other hand. We think not. We are of opinion that the Director of the Botanical Survey would be only too glad to have the sustained active co-operation of the department in this way. In the case of the Reporter on Economic Products, there can be little doubt that the Forest Officer with his special training and personal knowledge of the forests is perhaps the most efficient person to find out what are and what are not the most likely products to exploit, and the knowledge would be more quickly published and come at first hand if advertised by the Forest Specialist. In addition it would enable the heavily worked Reporter to devote all his energies to the agricultural staples of the country.

On the subject of acquiring the various specialists it may be pointed out that, since the department is officered by men who have received a sound scientific training, it may be taken for granted that from their numbers it will be possible to lay hands upon the requisite specialists.

THE STAFF.

A few words may be said on the subject of the staff required.

Working Plans.—We are of opinion that the Bureau, to be started upon good sound lines, would require two Working Plans officers. As already detailed, these men, whilst undertaking the work now performed by that over-worked individual the Assistant Inspector-General of Forests, would also tour round the country and make themselves practically acquainted with the method of working of each plan, would be in a position to decide upon questions of deviations from plans; would deal, under the Inspector-General, with the supervision of the preparation of new plans, would devote time to the study of sylviculture, etc.

Forest Botany.—The specialist would be required in connection with the investigation of commercial trees with a view to placing them upon the market. He would also make a special study of, and advise local officers upon, the question of the formation of plantations, and would draw up the pamphlets on the various

classes of forests in the country. He would also be in charge of Forest Botany, with all the branches above described.

Forest Entomology.—This appointment already exists, and a distinct advance has been made in this important branch.

Minor products.—The work upon which this officer would be engaged has already been fully detailed. He would be required to have some knowledge of Chemistry.

One of the staff would be placed in charge of the editorial work in connection with the publication of the yearly "Proceedings."

The question as to whether it might be necessary to set aside for the Bureau small areas of forest in various parts of the country for experimental purposes is a matter which need not be entered into here.

This question of the formation of a Forest Bureau is one which we have often heard debated amongst Forest Officers, but we have never heard a reference made to the strong parallel which exists between the Geological Survey and the Forest Department in this matter. Both have their "crops" to deal with—the one mineral, the other vegetable. The Geological Officers have to search for and find their crop, which is hidden in the bowels of the earth or strewn in unrecognisable or unmarked forms on the surface. For such work a Bureau of Specialists is required, and exists. Having discovered the "crop" the rest is left to private enterprise, and thus a large executive staff is not required. In addition, however, to this purely economic and commercial part of their duties, the scientific work performed annually by the Survey is of immense value. If now we consider the case of the Forest Department we see that the crop either exists on the surface or has to be created; but since it is an ever-changing one, being subject to constant additions and removals, a large executive staff is necessary for its present management and to ensure its continuance for future generations. This work more than fully occupies the whole of the time and energy of the present staff. The study of the sylviculture of the trees, enquiries into their commercial value, investigations into minor products, and that purely scientific work which reflects a lustre alike on a department and upon its

Government, all these have had in the past to be neglected. It is to undertake the important researches of this nature that we venture to suggest that the Forest Department should be placed in a position similar to that of the Geological Survey and that an Indian Bureau of Forestry should be formed.

SCIENTIFIC PAPERS.

THE CASUARINA BARK-EATING CATERPILLAR.

(*ARBELA TETRAONIS*, MOORE.)

BY C. E. C. FISCHER.

Those who have been favoured with a copy of Mr. Stebbing's Note on Casuarina Insect Pests* will recollect that the first insect dealt with bears the name that heads these lines.

Mr. Stebbing summarized the information then known, suggested protective measures, and stated six points on which further information was desirable.

It was in the Government plantation (the Agusti Nowgam reserved forest) near here that Mr. Stebbing studied the insect during a brief visit in July 1903; and as I have since then had the insect in that plantation under as close an observation as circumstances permitted and have had the experience of one year's attempted protection, I have drawn up the following note in the hopes that the conclusions come to will be of service.

It will not be amiss to preface a short description of the plantation itself. The Agusti Nowgam plantation was started in 1893. Its primary object was the protection of the fields of the village of the same name from the encroachment of drifting sand. The village to be protected is on the shore of the Bay of Bengal on the southern bank of the Rushikulya river, the chief water-

"A Note on the Casuarina Insect Pests of Madras," by E. P. Stebbing, F.L.S., F.E.S., Officiating Superintendent, Indian Museum, Calcutta; Office of the Superintendent of Government Printing, India, 1903.

course of the Ganjam district. Violent south-east winds carry the sand along to an almost incredible extent. (It is only by great and constant labour that the public buildings and offices of the adjacent small port of Gopalpur are kept free of the all-pervading sand.) Where any obstruction to the free drift of sand is met, the latter is piled up in dunes 50 feet and more in height, and the windward rows of Casuarinas are completely buried. In its protective mission the plantation has been entirely successful. The area of the reserve is 700 acres, but so far only 329 acres have been actually planted up. The area planted is V shaped; the threatened fields are in the angle, and the apex is presented to the south-east wind. The plantation has met with very varying success; in most places the result is highly satisfactory, but here and there patches have quite failed to produce useful trees. Not a little of the failure is due to water-logging in low-lying places, but by far the most important factor will probably prove to be a noxious fungoid disease, which is now under investigation. The maximum growth for ten years produced poles 75' high with a breast-height girth of 40".

The plantation is about $3\frac{1}{2}$ miles from Chatrapur, the chief market supplied. Owing to the sandy nature of the ground to be traversed, transport charges are rather heavy. Fortunately the presence of a considerable lake facilitates transport over some two miles of the distance. The quantity of wood annually exploitable is too small to warrant the laying of a trolley line, and the small demand, shared by two or three private plantations, precludes the planting up of a larger area for the present. A regular working plan was framed and sanctioned in 1903, but, as will be seen, had to be deviated from at the start. The plan provides for clear felling and uprooting over 32 acres every year (9 acres are reserved as a break-wind belt on the outside edge of the two legs of the V, leaving 320 acres to be felled over in ten years). The area felled is to be replanted during the ensuing rains. Originally, the seedlings were put out 6' x 6', but the plan provides for replanting 9' x 9', which is cheaper and gives better results.

To return to the insect pest. Its appearance in the plantation was first observed and pointed out to me by the Conservator of the Circle in December 1902. This was my first acquaintance with it, but the Conservator had seen it and its depredations elsewhere, and warned me accordingly.

The progress of the attack was closely watched, and specimens of the larva were sent to Mr. Stebbing. The attack on this occasion was not a severe one, and the insect appears to have first made an entry into the plantation in the month of September. The imago issued the following June and July; the new generation was then watched for, and was first observed early in September. It soon became very obvious that this fresh attack was far more intense than that of the previous year and had spread centrifugally from the site of the original attack.

Immediately curative measures were started, as suggested by Mr. Stebbing, and boys were sent round to collect and kill the larva under the charge of a watcher.

Almost from the beginning the impossibility of destroying all the larvae became evident, as the flexibility of the topmost branches, upon which their presence was visible, prevented their being climbed. The destruction was, however, persisted in for a time in the hopes of making a considerable impression on the invading hordes. Meanwhile the two watchers were marking with whitewash all trees on which the destructive covered ways of the larva could be seen.

When early in October, after the destruction of over 63,000 larva no appreciable diminution in numbers had been effected the urgency for more drastic measures became apparent. Sanction was obtained to depart from the provisions of the working plan by abandoning the felling of the year's coupe and cutting out all infected trees wherever found throughout the plantation. In addition the neighbourhood of the lake referred to above was taken advantage of, the felled poles being transported thither as soon as possible and immersed for several days. Unfortunately, owing to the heavy sand and the scarcity of labour just then, transport could not keep pace with felling, and the poles had to

be left lying in the plantation for some time. It is therefore possible that some of the larvæ migrated from felled to unfelled trees. There is, however, no evidence in support of this presumption, and as the larvæ are very reluctant to leave their retreats and covered ways this change of abode must not be accepted as certain. In all about 25,000 trees were felled. The result of this operation was awaited with some impatience. High hopes were entertained that the pest would be eradicated—hopes unfulfilled however.

At the end of August of this year (1904) the first covered ways of the new generation were observed. At first this was put down to a few trees attacked last year being overlooked, but this was soon seen not to account for the entire fresh outbreak.

Just outside the plantation, the villagers have themselves planted-up about an acre with Casuarina. This patch was attacked by the Arbelæ last year, and being somewhat concealed behind a hitherto uninfested portion of the reserve, was most unfortunately overlooked. The new attack is not of a very severe nature and is more restricted in its spread, so that the measures adopted last year were at least partially successful. It is hoped that a further operation including in its scope the small private patch will rid the plantation of the pest for some time at least.

The following observations on the insect and its habits, as they bear directly on protective methods, will, I hope, prove useful.

As Mr. Stebbing, in the Note already quoted, has described the Arbelæ in all its stages (excepting the ♂ imago not then seen by him), it will only be necessary to mention that the ♂ insect is similar to the ♀ but about half the size.

Life-history.—The moth issues during June. In 1903 a ♀ from a captive pupa issued on 3rd July, and in the current year a full grown larvæ was found on a Casuarina tree as late as the 23rd July. As a female bred out in captivity laid eggs within 24 hours of issuing from the pupal case, it would seem that the eggs are laid in June or July at latest. I have, however, no direct evidence on this point, nor as to where the eggs are laid, as I have not been

able to find them. I am, however, of opinion that they are laid directly on the boles of the trees, generally near the point of insertion of a branch or twig. This I conclude from finding very young larvæ, which must have been recently hatched out, fairly high on the trunks, already hidden in *separate* covered ways.

The earliest date on which the larvæ were observed was 26th August. They feed on the bark, restricting themselves to the superficial layers when very young and gradually working in deeper as they grow. From the very first the larva constructs a covered way made up of particles of its own excrement and bark joined with silk. The diameter of this covered way increases, of course with the growth of the caterpillar and extends in length. It may wander in any direction, up or down or horizontally, and may maintain a straight or a tortuous course.

At an early stage the larva constructs at one extremity of the covered way a small chamber under the bark, preferring to locate it in the upper angle formed by the junction of a twig with the bole. Here the grub rests when not feeding. It emerges to feed on the bark immediately surrounding the extremity of the "run," which is built up further as the bark is eaten around it. It apparently feeds at night, as I have never found it by day outside the covered way, nor indeed anywhere but in the chamber described.

The larva attains its full size by March or April, and then prepares the pupal chamber. Up to this stage it has penetrated the bark alone except where an existing hole has been utilised as a resting chamber. If such a suitable hole has been found, this is probably merely trimmed, otherwise the larva, being possessed of powerful mandibles, bores into the wood and excavates a pupal chamber about an inch in depth, and this it enters, for the final stage, in May and June, pupating with its head towards the orifice, which is concealed by the extremity of the covered way.

It being almost impossible to keep the larvæ alive in captivity, the exact duration of the pupal period cannot be easily observed. The only guide I have to go upon is that among several pupæ

brought to me on the 4th June was one which had not yet undergone the full transformation from the larval stage, and had therefore only just entered upon the pupal one. It remained alive till the 25th June, when it died, having then the appearance assumed by the chrysalis immediately before the imago issues. Hence it may be deduced that the pupal stage occupies from three to four weeks.

By the time the larva has reached its full size it is feeding so deep as to reach the wood, which is here and there exposed. In the current year pupæ, obtained by splitting open felled poles, were brought to me from the 3rd to 5th June, and the moths began issuing from the 7th of the same month. Several died and dried up. This was probably due to their being much shaken, as I had several changes of camp between the 7th and the 25th. Nevertheless some half a dozen moths of each sex were obtained. Two of the males I obtained from *Acacia leucophleia* trees. By touching the anterior extremity of the pupæ, which was near the surface, they were irritated into wriggling, and this brought them mechanically to the outside. In both cases the imago issued the next day.

It would have been interesting to know exactly how the pest found its way into the plantation as well as into the larger private plantation at Gopalpur (belonging to Mr. F. J. V. Minchin of Aska,) 10 miles distant; in both plantations it seems to have first appeared in 1902. Two other private plantations lying between the two referred to above have so far escaped attack.

The larva feeds on the bark of many grove and avenue trees in the vicinity of the attacked plantations, and doubtless spread from these. So far I have found it attacking the following: *Acacia leucophleia*, *Acacia arabica*, *Holarrhena antidysenterica*, *Anogeissus latifolia*, *Millettia auriculata*, *Eucalyptus globulus* (one). The first in the list is probably its favourite food, as along some of the roads where the species is planted every tree is the host of several of these insects.

As the caterpillars feed on species which contain such apparently obnoxious saps as those of *Eucalyptus* and *Holarrhena*,

it is reasonable to expect them to thrive on any other woody species. This question of discrimination as to food plant has considerable importance, as will be seen when protective measures come to be discussed.

Such pictures of the devastating action of this insect were presented to me, it being claimed that whole plantations had been destroyed, that I must confess to very serious alarm when I saw the extent of the attack in the plantation in September 1903. While still holding that a very severe attack is a very great threat to the life of many of the trees, if not of the whole plantation, I do not now think that a comparatively mild one would do much actual damage. I am led to this opinion by the fact that in another small Government plantation though every tree (15 or 16 years old) carried three or four larvae during the past year, not one seems the worse.

As Casuarina wood is used, here at least, almost exclusively as fuel and never in scantlings, the small bore holes do not depreciate the value.

If, however, a severe attack is experienced so that each tree is the host of a number of larvae (I found 28 on one small tree between 2 and 10 feet up), it is certain that the damage occasioned will be great, as such trees are liable to be ringed and killed. Even a slight attack, however, will kill young saplings up to a couple of inches in diameter, as was pointed out to me in the private plantation at Gopalpur, already referred to.

An incipient attack should therefore on no account be neglected, but where a plantation is in close proximity to wooded lands or avenues, once *Arbela tetraonis* appears in the tract, it will probably be impossible to keep it out of the plantation altogether. In these parts Casuarina is usually planted along the coast on pure sand in isolated plantations, and this affords protection from invasion to a certain extent, but, as unfortunately demonstrated in the instance under consideration, by no means absolutely.

The above record of observations shows that protection is by no means an easy matter; that probably no thoroughly efficient

action is possible, and further that curative measures must be drastic.*

It is proposed to plant a certain proportion of other species in admixture with the Casuarina (approximately 25 per cent), and this proposal is already being adopted in several Government plantations in the Madras Presidency. In the current year in the local plantation 5 acres outside the regular planting for the year have been planted up with 60 to 70 per cent of Casuarinas and 30 to 40 per cent of Tamarind, Dalbergia sissoo, Thespesia, Populnea Nim and Sapindus trifoliatus.

It is obvious that great circumspection must be exercised in selecting the species so as not to include such as are known to be attacked by the Arbela larva. At any rate, the admixture cannot fail to have a beneficial action in regard to the fungoid disease referred to previously.

It has also been suggested that the introduction of broad-leaved trees in the plantation will attract insectivorous birds. This result may well follow, but in view of the caterpillar's retiring habit I do not think that any birds except woodpeckers could reach it, and it is doubtful that these birds would live so near the sea.

A number of the moths might, it is true, be eaten by birds in their very short season; but here, too, I suspect protection by nocturnal flight, though I venture this statement with reserve. However, the moths bred out in captivity appeared more lively by artificial than by day light, and the only moth (δ) seen in a free state came into a rest-house at night, attracted by the lamp-light no doubt, and I found it at rest on the mosquito net in the early morning.

* I agree with Mr. Fischer that in the case of severe attacks such as he had to deal with in 1903 this should be so. It should be borne in mind however that such exceptional increases in the numbers of this pest are probably by no means of frequent occurrence. As an instance of how rarely the moth has been taken by collectors I may mention that there were but three specimens in the British Museum Collections in June last, one in the Indian Museum, taken in Calcutta by De Nicewill some ten years ago, and one specimen from Ganjam in my collections. In smaller attacks and to keep the insect within bounds year by year I think the method of handpicking by boys should be resorted to.—E. P. S.

As regards other enemies, I regret that I have nothing to record. The larvæ and pupæ kept under observation were quite free from the parasitism by other insects so frequent with other species of lepidoptera. Those larvæ which died in captivity appeared to have succumbed to uncongenial surroundings, dry wood and bark to live in and feed on, in place of green, and the pupæ died off from no apparent cause. I have found no predaceous insects in or near the covered ways, though I have examined a large number; and where small black ants were found haunting a hole occupied by a pupa, the latter appeared in no way inconvenienced. In short, the sole enemy of *Arbela tetraonis* at present known would seem to be man. As a curative measure, therefore, I do not see any practicable alternative to cutting out all infested trees, and I should be grateful for any suggestion on this point.

The compilation of a list of species which have been seen to be attacked by the pest would be most useful; and it is hoped that others will record their observations.

I think that now Mr. Stebbing's questions, except where they enquire regarding variation according to locality, can be answered as follows:—

1. The eggs are laid on the boles and larger branches at a height of from two to three feet to the topmost woody portions. They are probably laid singly or in groups of a few only. If laid in patches, then only a few hatch out. The number laid by one moth is not yet known; but a captive moth laid about 100 unfertilised eggs in one clump (she was in a small box and could not disseminate the eggs).

2. The larvæ hatch out at the end of August and during September.

3. The young larvæ do not live gregariously; from the first each makes its own covered way.

4. The larval stage lasts from September to May.

5. The pupal stage, probably, lasts from three to four weeks.

6. The moths appear in June.

Other Forest Officers will probably be able to throw further light on the habits of this pest which, until quite recently, were totally unknown.

P. S.—Since penning the above I have received an interesting note written by Mr. W. A. Stracey, Range Officer, Delta Range, Godavari District, and I cannot do better than quote it in his own words :—

"On my visit to the Kandikuppa plantation on 15th November 1903, I noticed several young trees completely girdled, and many of them were broken down by wind. The trees were also bored near the part girdled. The trees were completely girdled at various heights two to four feet from the ground. The bark and cambium were completely eaten through for a width of two to four inches. The borings in the trees were invariably in the upper part, although one case was noticed where the insect had bored into the stump. The trees above the part girdled were either dead or dying. I had several of them split up and removed. The worms I sent to Mr. Stebbing, who identified them as larvæ of "Arbela tetraonis." Some of the larvæ were evidently approaching the pupal stage. While I was in the plantation I had every tree found girdled cut down, split up and the larva killed. Fortunately the attack was not on a large scale."

"About a dozen plants each were so treated in two coupes, and the supervisor was instructed to do the same whenever he met with a plant attacked. The plants attacked were either those of the second or third year's growth. Very few attacks were noticed in the one year old coupe. In the Bendemoorlanka plantation also the attack was confined to young trees (two to four years old). Attacks on larger trees were not noticed. No attacks have been reported as yet this year."

It is clear that the plantation was saved from disaster by the prompt action taken by Mr. Stracey, the unwelcome guest being fortunately observed when the attack was very slight.

Mr. A. W. Lushington, Conservator, N. C., has endorsed on the above note.

"In or about 1894 the Kara Reserve in Kistna was annihilated by the borer."

ORIGINAL ARTICLES.

A FEW REMARKS CONCERNING THE FORESTS OF THE
JARRAH, EUCALYPTUS MARGINATA, AND OTHER
SPECIES OF EUCALYPTUS.

BY HERR DR. L. DEILS, BOTANICAL MUSEUM, BERLIN.

I have had the good fortune to spend fourteen months in the forests of Western Australia, from November 1900 to the end of December 1901, after which I travelled about a month in Tasmania to see the forests of *Eucalyptus globulus*. As some of the Australian Eucalyptus are cultivated in India, I have the hope that a few remarks regarding the constitution of these forests may be acceptable to the readers of the *Indian Forester*.

Eucalyptus marginata, the "Jarrah," is only to be found in the south-west corner of the State of Western Australia. This part of the Australian continent is remarkable for having regular rains during the winter, i.e., from April to October, the average annual amount being from 30 to 40 inches. The climatic conditions of this region, then, are very different from those prevailing throughout the arid interior of the Australian continent.

The area covered by *Eucalyptus marginata* in Western Australia is stated to be 8,000,000 acres. In fact, nearly the whole country between the mouth of the Moore River in the north and King George's Sound on the south coast may be described as one vast forest of *Eucalyptus marginata*. Next to the world-famed gold mines of the interior, these forests constitute the principal wealth of Western Australia.

The industry built upon it is steadily increasing. The beautiful red timber, so highly prized for paving blocks, is a conspicuous feature of Western Australian scenery. It meets your eye everywhere; all houses are built of it; planks and scantlings in huge piles are to be seen at the Railway stations and on the jetties for

export. It is never attacked by insects, and it is suited for all kinds of out-door work. Hence it is the staple timber of Western Australia.

In the lowlands between the coast and the inland plateaux, which are on the average about 20 miles wide, jarrah does not form compact forests, but grows scattered on the sandy plains, overtopping an undergrowth of two stories: a few small trees or tall shrubs—chiefly Proteaceæ—forming the upper story and an endless variety of low bushes with rigid branches and hard evergreen leaves the lower one. In these localities the jarrah has somewhat the shape of isolated oak trees in English parks, with spreading branches and broad crowns. Thus we see it near the lower Swan River; it gives the scenery round the city of Perth and suburbs its peculiar character. In this part of the country the trees are allowed to grow and are not utilized on a large scale.

The commercially important forests commence on the hills which form the western slope of the huge tableland of Australia. Here the appearance of the forest is gradually changing. The number of trees per acre increases rapidly; the elbow-room being less, the trees are growing taller, and, at the same time, the crown decreases in volume. The result is a dense and generally pure forest of this species.

Needless to say, this is brought about by a change of the external conditions. Here we find what is well known in all parts of the globe: the moist currents which come from the sea are compelled, when ascending the ghats, to give off part of their moisture. The rainfall is increasing. The soil, not being sandy, consists mainly of the gravelly détritus of the underlying granite, usually called "ironstone-formation."

Under such conditions the jarrah is seen at its best. The trees, attaining 90—120 ft. in height, are fairly well provided with foliage. Apart from an addition of *Eucalyptus calophylla* in places, there is no other arborescent species in these forests, the chief undergrowth being the younger generations of the jarrah itself.

This extraordinary uniformity of the chief constituents of the forest is in striking contrast with the endless variety of small bushes, about $1\frac{1}{2}$ —3 ft. high, which cover the whole ground with their evergreen foliage, and adorn it, during the rainy season, with the rare splendour of their flowers.

This feature makes the jarrah forest very different from the type of Eucalyptus forests common on the tableland of the Eastern States of Australia. In these regions the forests are more open. The ground is covered mainly with grasses and annuals, which make their appearance in the rainy season. The green carpet beneath the lofty trees gives a very pleasant aspect to these forests during the wet months, but it vanishes rapidly as soon as the hot weather approaches.

Even more different is the aspect of the jarrah forest from the woody vegetation of the central portions of Southern Australia. For in these desert regions the scrub mainly consists of various low-growing, almost shrubby, species of *Eucalyptus* and *Acaria*, growing intermixed.

It is not very difficult to recognize *Eucalyptus marginata* in the genus. The trunk is covered by greyish brown bark. The leaves show the common shape of *Eucalyptus*, drooping in the adult state of the tree, but being erect on the young plant. Otherwise there are no pronounced differences between the young foliage and the old.

The conditions which regulate the production of flowers and seeds have not yet been sufficiently studied. I have seen flowers on medium sized shrubs of jarrah of apparently quite a young age. In other localities tall trees only produced flowers. I have found flowers in November, June, and occasionally in other months of the year, but never very plentiful. I was told, however, that from time to time, as is the case with the beech and other forest trees, a heavy seed-year occurs, when the whole forest is said to be one mass of white flowers.

As mentioned above, *Eucalyptus calophylla* is the only species to be met with as a companion of *Eucalyptus marginata*. Never constituting a forest by itself, it is intermixed freely with *Eucalyptus*

marginata or a few other species of more social habits. When growing isolated, *Eucalyptus calophylla* has a most beautiful appearance, strikingly similar to the oak in Richmond Park.

As indicated by its name, the foliage is the principal adornment of this fine species : it is very dense and of a rich green colour. The shape of the leaf, as well as its nervation, are of a type not common in the *Eucalyptus* genus. Still more extraordinary, however, is the position of the leaves towards the light. While most of the other *Eucalyptus* have their leaves drooping or erect, that is, vertical, the leaf of *Eucalyptus calophylla* is horizontal, following the habit of the vast majority of trees. It follows that *Eucalyptus calophylla* is a much more shady tree than most of the other species.

The shape of the large flowers and fruits also is nearly unique in the genus. It is certainly one of the most distinct species of *Eucalyptus* indigenous to Western Australia.

Economically, *Eucalyptus calophylla* ranks far below *E. marginata*. Still it is very ornamental; the gum-resin is valuable on account of its medicinal properties, and the bark is used for tanning. The timber is much inferior in quality to that of other species.

Another important species of Western Australia is *Eucalyptus diversicolor*, the "karri." It is perhaps the finest tree of the country. The trunk is very straight. The smooth bark peels somewhat like that of the plane ; it is always white and clean. The height of the tree is unsurpassed in Western Australia, and equalled only by *Eucalyptus amygdalina* of the south-east corner of Victoria. Specimens about 200 ft. high and 40 ft. in diameter at 3—4 ft. from the ground and about 120—150 ft. to the first branch are by no means uncommon; much larger trees, up to 300 ft. high, have been actually measured.

Eucalyptus diversicolor has a very limited geographical area on the south coast of Western Australia, from Cape Leeuwin to King George's Sound. This is the wettest part of Western Australia, where the dry period of the year is less pronounced and the heat of the summer considerably reduced. A narrow strip of land along the coast is covered by forests of this gigantic tree.

The finest growth is to be seen on rich "ironstone" soil. The forests of karri are just as pure as those of jarrah, while the undergrowth is of a similar description.

In conclusion, I may be allowed to add a few remarks regarding the natural conditions of the forests of *Eucalyptus globulus*. This species, the Eucalyptus best known outside Australia, enjoys conditions of life more favourable than most of its congeners. It is indigenous to Tasmania. The more or less periodical rains of continental Australia are here, on this mountainous island, replaced by a fair rainfall all the year round. Hence the appearance of the woods of *globulus* is different from most continental types of Eucalyptus forest.

In Tasmania the enormous columns of the dominant tree reach a height of above 200 ft., the drooping foliage spreading a light veil above the umbrageous trees of the undergrowth. This lower story is much more conspicuous than anything in the continental forests. First, there are the saplings of *globulus* itself, with their strange glaucous foliage, so utterly different from the narrow alternate petiolated leaves of later life. Then there are a number of pretty trees with soft foliage, many of which are remarkable for their affinity to species of the Indian Archipelago. Among these are often fine specimens of fern-trees, species of *Dicksonia* and *Cyathea*, their black stems completely covered by filmy ferns, mosses and liverworts. The ground is hidden by fallen logs and branches, with thick layers of moss upon them; by huge tufts of ferns growing between, and by tall herbs rooting in the deep black soil. Altogether, the primeval forest of *Eucalyptus globulus*, with its harmonious combination of every possible shade of green, makes one of the grandest pictures of vegetable life, quite unlike any tropical scenery, and at the same time entirely different from anything which makes the forest of the more temperate zones so delightful.

Our illustration shows the growth of *Eucalyptus globulus* at Ootacamund which, we think, will prove of interest to Dr. Deils and our readers. It is reproduced from a photograph very kindly taken by Mr. H. Jackson, I.F.S.—HON. ED.

RIVER PROTECTIVE WORKS AT DEHRA GHAZI KHAN.

BY G. M. RYAN, F.L.S., I.F.S.

"It has been decided by the Government of India that no more money shall be spent on protective works at Dehra Ghazi Khan." Such is the announcement which appears in the issue of a contemporary of the 28th July last, and it is reproduced in order to draw attention to the general policy of the P.W. Department in dealing with the protective works on the Indus, a policy which, it is urged, is not based on sound economic lines.

Large sums of money were spent in endeavouring to save Dehra from destruction by flood and erosion, and the expenditure of further large sums was contemplated. A Sind Engineer's services were, however, brought into requisition, and he advocated a relatively inexpensive scheme of protection. This was tried, but failed. Now it has been apparently decided that all further attempts to protect that military station from destruction shall be abandoned, and if such is the case, the question arises, could not this have been foreseen at the outset?

Although I have not visited Dehra Ghazi Khan, some years ago I made a study of the history of the Indus, and was able to form certain conclusions about the laws governing its vagaries; and these subsequent results seem to have confirmed. I think it is possible to lay down a few broad principles for guidance in regard to the erection of protective works along both banks of the stream, which might be followed.

In an article published in the *Indian Forester* in 1896 (Vol. XXII, page 119), entitled "The River and the Best Method of Embanking it," I attempted to show how the various belts of vegetation along the Indus in Sind came into existence and were arranged as it were in a *natural order* along both its banks, and how futile it was to erect embankments as protective works counter to their gradual development.

The risks run by persisting in the present bund policy were also pointed out; that no properly thought out working plan existed for protective works on the river; that one Engineer put into operation a scheme in his Division, the full details of which

were unknown perhaps to the officer of the adjacent Divisions ; and that works in one locality naturally had a prejudicial effect on the protective works in another.

Although the observations and conclusions in the article alluded to refer almost exclusively to Sind, and although Sind and the Punjab are two different Provinces, the geological character of the flat alluvial plain through which the Indus runs in both is so similar that the arguments which have been used in support of the contention in the one case could be made applicable in the other.

That the conditions are somewhat analogous is borne out by the fact that a Sind Engineer was ultimately brought in to try and grapple with the problems at Dehra Ghazi Khan.

I need scarcely say that my criticisms are made in no hostile spirit to the great P. W. Department. My contention is that the bund policy in Sind tends to raise the level of the sectional area of the river within the bunds, and that when this area has been gradually elevated, the stream proceeds to swerve to a lower level, which is, of course, outside the area of the bund, and that no amount of works of protection will prevent erosion of the banks when the river has thus made a *set* on to them. This is what, it is to be supposed, happened at Dehra Ghazi Khan, and if the P. W. Department had properly grasped the situation the futile attempts to stem the onward march of the river would never have been made.

The elevation of the sectional area of the river between the bunds is a factor in the question which the P. W. Department do not accept. So far back as in 1896, when the matter was broached to an experienced Engineer in Sind, he replied "that the embankments raise the river level is certainly open to doubt except in areas subject to tidal influence." If doubts existed eight years ago, have any data been obtained since to disprove the theory? According to Sir Evan James, Commissioner in Sind (see remarks later on), Government in 1896 were going to appoint a special officer, whose sole charge was to be the Indus, to watch its vagaries and ascertain if there were any laws under which it acts. If this officer was appointed, as presumably he was, he might be able now to throw some light on the subject, and it would be interesting to

hear whether my observations and conclusions are confirmed or not.

The embankments which were laid down everywhere in Sind up to the time, at any rate, when I left that Province, *viz.*, 1897, were aligned without a thought apparently beyond present necessity. This is surely not the correct policy.

This plan of closely hemming in the lateral overflows of the Indus by high earthern embankments is one that affects forest officers in Sind especially, for the building of these walls close to the cold-weather course of the river in that Province causes the forests situated outside that wall to be shut off in the flood season from the water-supply to which they are legitimately entitled, and loss of irrigation facilities for the forests means, of course, their practical extinction. My letter already alluded to was written with the object of drawing attention to this matter. I see from the Sind Annual Administration Report for 1901-02 that this question was still under discussion. The Conservator in alluding to natural regeneration, para. 44, wrote—"In perhaps half the forest area, having only its natural difficulties to contend with, a satisfactory and, in some cases, excellent natural regeneration is present. In the other half of the forest area there is little or no regeneration either because the land is above flood level or because some bund or *canal bank has made a desert of it*. I am making a special representation to Government on this point." And again (para. 95)—"The progressive deterioration of the forests due to constantly increasing bunds and canal banks has naturally produced a state of moral weakness and want of confidence which results in babul lands being sown with inferior but hardy khandi, rather than risk disasters like that of Miani or the simple failures that have been so frequent."

The Commissioner, Mr. Cumine, in reviewing Mr. Gleadow's report wrote—"The question whether, now that the flood waters have been so much cut off by 'bunds' from the forests that lie back from the river, there ought not to be a definite irrigation scheme worked out for each such forest will engage the attention of the Commissioner during the present touring season."

If the bund policy of the P. W. Department as regards the erection of embankments is to be persisted in the only alternative would appear to be Mr. Cumine's very reasonable suggestion.

Since writing the above, telegraphic news has reached the Bombay papers that the Kushmore Bund, which is at the extreme north of the Province of Sind, and which is an important work intended for the protection of the Jacobabad and Shikarpur districts, has been breached. The breaching of this bund is a very serious matter indeed. During the inundation season the Executive Engineer of the district is under the necessity of residing close to it, or practically on it, and a small army of men are entertained to patrol it night and day, in order that any damage may be promptly reported and repaired. That a serious breach under the circumstances should have taken place indicates either neglect on the part of the local staff to do their duty satisfactorily or that the damage was out of their power to prevent; and it is thought the latter is probably the correct explanation of the case.

Admitting the latter explanation, the increased apparent height of the floods in the vicinity of Kashmir, compared to those of previous years, seems the obvious explanation, and this is yet another argument in corroboration of the theory regarding one of the direct effects of the protective works on the Indus.

The P. W. Department are apparently quite satisfied because by their policy Government are realising by the embankment system in Sind a profit of 11% on the capital outlay (*vide* para. 12 of the Sind Administration Report for 1893-94 quoted in part in the *Indian Forester*, pages 57 and 58, Vol. XXII), but this figure does not indicate the real state of things. It is based merely on the profits realised from assessment on agricultural land, and the enormous losses by erosion of valuable forests, which it has taken a century or more to rear, and which were (in 1894) comparatively the most valuable per acre in India (*vide* para. 119 of the Sind Administration Report for 1893-94), are not taken into consideration; neither are the losses resulting from shutting off the water-supply from extensive

tracts, forests or otherwise, which are thereby rendered sterile, being covered with salty efflorescence.

In 1894 the question of placing the bunds much further back from the cold-weather course of the river was raised by myself, and the Commissioner in Sind, Sir Evan James, who was sent a copy of my notes on the subject, wrote very courteously as follows :—

"The bund policy that has been followed in Sind of late years was called in question by Mr. Joyner and thoroughly gone into and decided upon by Government not long ago. I think, therefore, it is unnecessary to raise the question again. Government are going to appoint a special officer, whose sole charge will be the river Indus, to watch its vagaries and ascertain the laws under which it acts. As a matter of fact, in the matter of bunds as in everything else, we have to cut our coat according to our cloth. Bunds are enormously extensive, and the further away from the river the more they cost, as the river runs along a ridge,* and bunds in lowlying ground are extremely expensive to build and maintain. Of the merits of the policy pursued, the revenue returns are the best proofs. The more care taken in repairing and extending bunds, where found necessary, the greater and steadier has been the increase of revenue, *i.e.*, of cultivation. The uncertainty attending all cultivation and the loss and misery that results therefrom would be so enormous that any attempt to dispense with bunds would be quite out of the question.† Admitting, then, that bunds are necessary, the question of where to place them depends mainly on the set of the river, the height of the land, and the money available. No doubt to you as a Forest Officer it would be pleasant to have a large forest-clad area on both sides of the Indus, but it would not be pleasant to the owners of the present lands to see their property practically destroyed."

I also submitted my notes together with Sir Evan James' reply to Mr. Young, one of the ablest Engineers of the Province,

* In my paper on the best method of embanking the Indus this is all shown in diagrams.

† The abandonment of bunds, as will be seen from my paper, is not advocated.

S. B. Mondal, det.

The Growth of Spike in Sandal.

Photo:



at the time, and although I am precluded from quoting all what Mr. Young said, because he has since retired and I have not his permission to quote his remarks, which are marked private, he stated that the Commissioner had given a very fair, concise and correct reply to my plea.

This being the opinion of the P. W. Department, it can only be repeated that their policy of trying to hem in closely the lateral overflows of the Indus does not appear to be invariably based on sound economic lines, and with the Dehra Ghazi Khan example before us, it would seem that the bund policy is scarcely one to be blindly followed. If my remarks meet the eye of any P. W. Department Engineer, it would be interesting if he would give us his side of the case in the pages of the magazine, taking this article in conjunction with my previous one.

The absence of vegetation along both its banks and the character and disposition of such vegetation, if existing in almost gregarious belts, form a valuable index as to the best and most economical alignment to be followed in the long run for its embankment system, and until the P. W. Department realise this, it is believed that success in grappling with the Indus River problems can never be satisfactorily achieved.

CORRESPONDENCE.

GROWTH OF SPIKE IN SANDAL.

The extremely interesting and excellent photograph on the "Growth of Spike in Sandal," which was most kindly taken by Mrs. Andrew, was sent to us with the following note by Mr. P. M. Lushington :—

Enclosed is rather an interesting photograph of " Spike " taken by Mrs. Andrew.

The left-hand flower-pot contains a branch of a healthy plant, the second contains a branch just attacked. The leaves have begun to " bunch " and grow smaller. The third has two branches. On

the left one taken from a tree badly attacked, the other with hardly a leaf left, *i.e.*, in the final stage just before death.

I don't know if you can print in the *Indian Forester* from an ordinary photograph ; if so, this may be useful to you ; if not, will you kindly return it.

P. M. LUSHINGTON.

Coimbatore.

WORKING PLANS.

In the September and October numbers of the *Indian Forester* are two articles by "More Light" under the title of "Proportionate Fellings in Sal Forests."

The remarks in the first article apply so generally to all working plans that it may not be out of place to refer to the subject again and especially to invite the attention of the Honorary Editor to the suggestions given below :—

(2) Defective as many of our working plans may have been, it is rather severe to lay the blame on them if the forests concerned are only a few degrees less abnormal at the ends of the periods covered.

To begin with, our use of the term "working plan" is rather loose. It may mean a plan extending throughout the whole life-history of a tree (*i.e.*, tree rotation), or else it may include only a single felling rotation, of anything from 10 to 45 years. In India the term generally has the latter meaning, so that in the course of one "tree rotation" there may be a whole series of working plans.

It would have conduced to greater precision in the use of these technical terms if such successive plans had been called "periodic plans" or "subsidiary plans," or even "plans of operations," and to have kept the term "working plan" exclusively for the main scheme—underlying all the periodic plans in succession—for first bringing a forest to normal conditions and then for keeping it so.

Until a forest is normal there can, ordinarily, be only one working plan, but there may be any number of periodic plans, owing to the difficulty of going much into detail very far beforehand.

In all our working plans, at or near the beginning of Part II, there are three prescribed sections—

- (a) Object sought to be obtained.
- (b) Method of treatment.
- (c) Exploitable age or size.

These three sections constitute the working plan proper, and must run through all the series of periodic plans until the forest is normal, with only such modification of elaboration as experience or necessity may call for.

Any alteration of sylvicultural importance in the "Objects of management" must mean a far more decided break in the life-history of a forest than the winding up of one merely periodic plan and the starting of another.

The "Method of treatment" should be included in the plan proper; because the changes in it ought not to be other than few and far between. The second periodic plan may differ from the first one, and the third from the second, but by that time permanency should have been reached.

3. It is to be regretted that these three sections are not printed separately from the rest of the details in our working plans. Only rarely do they, at present, take up more than a page of foolscap, so that the circulation of them to all divisions would not be very troublesome. If the Honorary Editor would, even in an entirely unofficial way, publish such a summary* for all working plans in India and Burma, or even simply a list or index of them, he would render great service to the department. Having thus brought matters up to date, there would probably be plenty of room in the ordinary numbers of the *Indian Forester* for summaries of new plans on publication, and for an extra index once a year.

At present, no one outside the Imperial Forest School or the Office of the Inspector-General has access to all the working plans in existence, and so it is often next to impossible to find out what has been done in other divisions.

* We should be delighted to publish brief summaries of this nature if the officers who prepared the plans or those now engaged in working them would forward them to us.—HON. ED.

In the early days of working plans in India, 100 copies of each were printed, and there was a pretty general circulation of them. Now-a-days only some 25 to 30 copies are issued, so that the books do not ordinarily travel outside a single circle, let alone into other provinces.

4. It must also be tolerably certain that our working plans contain much other information which it would be to the advantage of the service to have easily accessible. Representing, as they do, in a condensed form, the results of the study of a particular forest or series of forests, by specially appointed and professionally trained Forest officers, it is only reasonable to suppose that the observations recorded and the deductions made would be of material assistance to other officers engaged on similar work.

I have written one working plan myself, but there was little or nothing original in it. I read every plan on similar lines that I could get hold of, and made use of everything in them that I could. In my opinion every working plan officer should do the same.

All the information in working plans is more or less of interest and permanent value, but instead of issuing the books as they are to all officers, a better plan would be to take them to pieces and to issue summaries of them in a series of separate parts. Thus—

Series I.—Working plan proper.

(*Vide para. 2 above.*)

II.—Physical and general conditions.

Situation, soil, spring water level, configuration of ground, climate, etc.

Series III.—Growing stock.

The tree growth and the chief injuries to which subject.

IV.—Data.

Density of stock, growth in height and girth, and form factors of the principal species.

V.—Utilization.

Markets ; saleable products, etc.

Series VI.—Felling Regulations.

Main fellings and subsidiary ones.

„ VII.—Supplementary Regulations.

Fire, conservancy, roads, buildings, planting, etc.

5. The actual details and number of the above series would probably require further consideration, but there can be very little doubt that the publication of some such sets of summaries of all existing working plans would be very valuable, and the issue of similar papers in each series, on each new plan as it appeared, would make readily accessible to everyone much of what is known of the more important species in our forests.

The mere circulation of working plans in their ordinary book-form would not be so useful. Even if all officers interested in the *sal* or *text* had access to the hundred or more plans in existence for each of them, still the load of the books could not be carted about in camp, and so they could only be used at headquarters. Even then, in order to learn something of any particular subject being worked out at the time, it would be necessary to wade through a huge mass of irrelevant material.

The Agricultural Ledger Series of pamphlets is an excellent example of the sort of thing that is wanted.* Each paper has a double set of numbers so that the papers can be bound in annual volumes or grouped in each special series as desired.

6. There should be little or no difficulty in compiling such summaries of working plans. In the first place, the authors of plans could be asked to put together the required summaries within certain limits of space. In other cases, the Honorary Editor could, doubtless, make arrangements. Once started, there should be no further trouble.

The summaries would not need to be in exactly the same words as in the printed books, so long as the information in them was the same. Supplementary information should appear in the form of foot-notes or in a "Remarks" column. As the

* The Annual "Proceedings" published by the Director of the Geological Survey furnish an even better example of the kind of annual publication the department requires.—HON. ED.

summaries would not be, in any sense of the term, criticisms of the plans, authors of plans should have no objection to the publication of them, especially if given the first refusal of the drafting of them.

The order of publication would naturally be chronological, based on the dates of sanction. Only in this way would the plans themselves appear in their right perspective, and be of use in tracing the gradual development of the science of forest management in India.

31st October 1904.

X. Y. Z.

A LARGE INDIAN MAHOGANY TREE.

It may be interesting to readers of the *Indian Forester* to know the measurements of a magnificent mahogany tree which stands in the beautiful grounds of the Hyderabad Residency in the "Rung Mahal" Gardens.

Possibly this tree may be the biggest of its species in India. It is a pity that it was not pruned in its youth, since the bole is short. At breast height its girth is 16 ft. 4 in., but at the height of 9ft. 3in. it branches off into six different limbs, which vary in girth from 5ft. to 7 $\frac{1}{2}$ ft. The tree has attained a height of 130ft. and is in fine foliage.

I presume its age cannot be more than 109 years, since I believe seed was first introduced from the West Indies to Calcutta in 1795. I have not been able to ascertain if the tree has ever seeded.

The Residency was commenced and completed during Colonel Kirkpatrick's tenure of office as Resident between the years 1797 and 1805.

W. F. BISCOE,

HYDERABAD : Conservator of Forests,

22nd October 1904. H. H. the Nizam's Dominions.

REVIEWS AND TRANSLATIONS.

THE REVIEW OF FOREST ADMINISTRATION IN BRITISH INDIA, 1902-03.

Readers of the magazine will perhaps understand why it is with very considerable trepidation that the writer answers to the demand made upon him to undertake a criticism of the Inspector-General's Annual Review of Forest Administration in India. The reviewer nowadays is expected to forsake that deep-cut track followed through 30 volumes of the *Indian Forester* and to produce an article containing originality combined with wise and delicate criticism instead of pursuing that easier and broader way which needs but the scissors and the gum bottle. Even this path would not, however, prove to be set with insuperable difficulties were it not for the fact that one has to endeavour to so choose one's terms and phrases that, whilst criticising favourably or unfavourably the report (since a review must necessarily do the one or the other), there should be no suggestion of praise (which we have heard termed gross flattery) of the Government of India on the one hand and of criticism of Local Governments or their forest advisers and staff on the other. We would ask our readers to bear in mind, however, that *cuiusvis hominis est errare*—even possibly themselves when they betake themselves to the pen of criticism.

Very little alteration in the total area of the forests in charge of the Department took place during the year. A mention is made however of the fact that the proportion of area under forest management to that of the total area of each Province varies greatly, from 66·3 per cent in Burma to 39 in the United Provinces and Oudh, so that whilst the average for all Provinces amounts to 22·4 per cent, the proportion in each is not so satisfactory as might be inferred.

Forest Settlement work still proceeds apace, and Burma with 983 and Madras with 502 square miles of finally settled reserves are especially noted, the major portion of the 2,363 square miles undergoing settlement at the close of the year being situated in these two Provinces.

The remarks on the demarcation of forest boundaries will prove of interest, and the figures will not unlikely occasion some surprise. In the Bengal Presidency there are about 74,000 miles of forest boundary, in Madras 34,000 miles, and in Bombay about 45,000 miles. Some 5,469 miles still require demarcation in the Bengal Presidency, the Punjab being responsible for $\frac{3}{4}$ ths of this deficit; 1,859 miles are in Madras and 16,404 in Bombay, where the forest area consists, in many places, of small isolated blocks. At the present rate of progress demarcation will be complete in Bengal in about five years, in Madras in one year, and in Bombay in about fifteen years. The satisfactory progress of demarcation in Burma, where the forest area is being constantly increased by the addition of new reserves, is very noteworthy.

We are glad to be able to record that good progress is being made in the survey work. Whilst a good map is indispensable before a working plan can be drawn up for any particular area, it is almost an equal necessity to the Divisional Officer if his duties are to be efficiently carried out. During the year a total of 350 sheets has been published, including eleven working plans and other special maps. Advance tracings and chocolate prints when required for working plan purposes were also supplied to Forest officers.

The progress in that important branch of work, the preparation of working plans, is called "satisfactory," but the term is very considerably qualified by the remark "when it is remembered that the Department is in most Provinces short-handed, and that the deputation of officers for the compilation of working plans is often at the expense of equally important work." This remark applies only to the preparation. There is also the heavy work in connection with the drawing up of the preliminary notes, the revision of obsolete plans, and general supervision to be considered. We trust that the Government of India will soon see its way to the formation of a working plans branch, consisting of a special staff, which will be responsible, under the Inspector-General, for all working plans work. We think that there can be no two opinions amongst professional men as to the urgent need for the formation

of such a staff or as to the immense value it will prove, both to the Government of India and Local Administrations alike.

The total area under working plans is 33,264 square miles (Bengal, 25,851, Madras, 3,993, Bombay, 3,420), or roughly a little over one-third of the total area of the reserves.

The report notes with satisfaction that the importance of opening out communications and of erecting buildings is being recognised in most Provinces. The remarks on the former will bear quoting—"Of the Rs. 1,03,990 expended on new work, the United Provinces and Madras head the list each with an expenditure of over Rs. 19,000, which was closely approximated in Bengal. In the Central Provinces an outlay of over Rs. 14,000 during the year as compared with that of Rs. 829 in 1901-02 proves the intention of the Administration to afford facilities for the removal of forest produce. The small expenditure in the Punjab, in Assam, in Bombay, and in Burma appears to be regrettable. In the latter Province two Conservators remark on the absence of roads and on the result this must have on forest exploitation, while a third points out that the paucity of supervision and difficulty of procuring labour form a serious drawback to the prompt opening out of needful communications. There is probably no form of forest expenditure which has so much direct influence on forest revenues as the construction and upkeep of export roads and inspection paths, and liberal outlay in this direction is necessary if satisfactory and speedy development of the valuable State forests is to be attained."

"The expenditure on buildings, amounting to Rs. 3,26,116, shows an increase of Rs. 64,277, to which almost all the more important Provinces contribute their share. Assam alone shows a saving both on new works and repairs on the comparatively insignificant sum of Rs. 10,000 expended during 1901-02."

"Under new works Burma still heads the list with Rs. 50,000, followed by the United Provinces with Rs. 39,000 and Madras with Rs. 32,000; Bengal, Bombay and the Central Provinces coming next with Rs. 24,000, Rs. 23,000, and Rs. 20,000, respectively. The large increase in activity in Bombay is specially noticeable. The record

of the year under this head is most satisfactory as showing that the importance of providing shelter for the Forest staff has received adequate attention in most Provinces."

On the subject of Forest offences we read some remarks which would appear to be addressed to the Department at large. After commenting upon the various reasons assigned for local variations in the numbers of Forest offences the report continues—"Putting aside other causes as affecting results only to a minor extent, it may safely be asserted that any large increase in Forest offences denotes either that the restrictions placed upon the people are intolerable or that it is worth while to evade them. Both the intolerance and evasion may indeed be only temporary, due to a falling off in local prosperity for which provision should have been made in increased liberality in the utilisation of State forests; but when in normal circumstances, on which Forest rules and settlements are necessarily based, Forest offences increase in number, further enquiry into local conditions becomes desirable in order to decide between the requirements of the tenantry and those of the forest, in justice to both." We think that this note has the true ring in it, the note of the broad-minded, able forest administrator in contradistinction to those foresters who consider the reserved forests as so many sacred preserves into which no one unrobed in the sylvan garb and unarmed with the insignia of office may enter and from which the taking of a few dry sticks, the lopping of a few branches, the grubbing up of a few wild edible roots or the grazing of a few hungry cattle in times of stress is a matter for the criminal courts. Just so soon as the people realise that the closed forests are really their bank, upon which they will always be permitted to draw in periods of dire distress, so soon will the police work of the department be reduced to the irreducible minimum, and the arrival of this happy millenium is in the hands of the department alone.

"The area under protection from fire increased during the year by 1,763 square miles, the principal additions being made in Burma and the Central Provinces. It now reaches a total of 36,651 square miles. Of this area, however, a certain proportion is left without

the supervision of a special staff, with the inevitable result that fires are unusually frequent. In future it will be unnecessary to take such areas into account when considering the results of organised fire conservancy, for if a forest is worth protecting the expenditure involved in supplementing mechanical aids to success by the entertainment of a staff of watchers is also justified, and if it is not incurred those forests which are not specially protected may more conveniently be classified with others which, by their nature, are self-protected." We cannot but think that this point has been somewhat lost sight of in the articles that have appeared in the magazine on fire protection in teak forests in Burma and the questionable necessity thereof. One reason put forward by several of the writers has been that this work entailed keeping the Forest guards entirely on fire operations, and that consequently the Forest work and supervision suffered. Fire protection in its proper sense surely necessitates the entertainment of a special staff of fire patrols during the dangerous period, and if these men do their duty properly the Forest guards should be able to carry on their work in their customary manner. We view the decision now come to as a move very much in the right direction; and one wonders how a forest with merely a cleared line of greater or less width round it ever came into the category of 'fire protected.' Burma, where the difficulties of extinguishing fires can be easily understood, shows the highest percentage of fires, followed by Bombay. The remark that 'in certain circumstances the beneficial effects of the exclusion of forest fires are not apparent for many years may perhaps allude to the fact that the Government of India are more inclined to agree with the Local Government than with the writers of the articles on fire protection in teak forests as to the policy to be pursued in Burma.

Year by year the grazing question comes nearer to a satisfactory solution for those chiefly concerned. Only about 17 per cent of the State forests are closed entirely to cattle, and these in time of scarcity would be thrown open. We agree with the report that, in face of these statistics, it cannot be maintained that the interests of the agricultural or cattle-breeding communities are

subordinated to those of forest conservancy in India. Taken as a whole, the State forests provide a large proportion of the grazing grounds of the Empire and also constitute a reserve area which may, in time of need, be of the utmost importance. Under sylviculture the following remark appears to be more particularly applicable to Burma under present circumstances : "Operations for the purpose of aiding the natural reproduction of the principal trees do not appear to have been frequent, although they must in many cases be almost a necessity in these areas, where the effects of fire conservancy result in favouring the inferior growth. From some Circles are recorded interesting details of the progress of investigations or of experiments made in the endeavour to ascertain the reason of the failure of teak regeneration in protected forests. So far as these have proceeded it appears evident that the absence of sufficient light or the presence of excessive undergrowth are the retarding causes ; but the problem of how to provide, over large areas of natural forest, for the former without inducing the latter is still unsolved."

As regards minor products investigations are said to have been in progress *in re* Musa fibre, cassava cultivation, the manufacture of wood and bamboo pulp for paper-making and the value of various latices of rubber-producing plants. "Much valuable information was collected, which will, it is hoped, lead to the utilisation of many forest products whose value has up to the present been overlooked or neglected." We think we are correct in saying that concerning some of these materials much information has been collected in past years by individual officers. Some of this has found its way into the office of the Reporter on Economic Products ; other portions have remained stored in the heads of the individuals themselves, and the remainder, perhaps the major portion, has passed on to find its final resting-place in the voluminous pages of the formidable Annual Reports of a prehistoric generation of Conservators, or in the tightly-packed pigeon-holes of their offices. We are unable to perceive how such information is to be made available and useful to the department at large in the future until there is some form of annual official departmental

publication into which it can be collected and issued for general reference.

The following statement shows the outturn of timber, fuel, bamboos and minor forest produce from all forests, reserved, protected and unclassed, under the control of the Forest Department:—

Presidency	Timber and Fuel.	Bamboos.	Minor Produce.
		C. ft.	No.
Bengal	{ 1902-03	181,345,643	282,851,296
	1901-02	170,735,735	142,919,425
Madras	{ 1902-03	21,958,556	35,844,728
	1901-02	18,730,441	39,217,618
Bombay	{ 1902-03	42,596,413	4,479,201
	1901-02	42,13,4901	4,662,295
GRAND TOTAL		245,900,612	323,175,225
		231,661,077	186,799,338
			46,11,351
			45,38,133

This shows an increase of about 14 millions of cubic feet in the outturn of timber and fuel and 136 millions of bamboos; the latter mostly from Burma.

It will come as a surprise to many that the demands of grantees and right-holders absorbed about *one-third of the total outturn* from the forests of the State, whilst the total minor produce bestowed free of cost to private individuals living in the vicinity of the forests comes to approximately the same figure.

As showing that the forest estate is commercially on a sound basis, it is satisfactory to note that the gross revenue (Rs. 1,94,71,540) was Rs. 16,47,825 in excess of last year, and Rs. 7,83,982 in excess of the average of the past five years. The surplus amounted to Rs. 82,22,209, being Rs. 11,44,882 in excess of 1901-02, and Rs. 1,66,396 in excess of the average of the past five years.

The value of produce given free to those resident in the neighbourhood of the forests was Rs. 21,60,904 in Bengal and Burma, Rs. 64,053 in Madras, and Rs. 10,97,000 in Bombay. As is

customary, no credit was taken for this sum of Rs.33,21,957, which amounts to about one-sixth of the gross revenue collected in the State forests. Especially with regard to grazing is the liberality of the Government evident, as the value of free grazing equals the amount of revenue collected under this head.

The report alludes to the fact that twenty officers from the Imperial and Provincial Services were on foreign service during the year in Ceylon, Egypt, South Africa, Malay States, South Nigeria, Siam, Trinidad, Mauritius, etc., whilst applications from others, including several from Native States in India itself, had to be refused owing to the short-handedness of the staff and the impossibility of supplying the men. During the year there was no change in the sanctioned establishment.

In conclusion we would wish to look back a year and re-quote a paragraph* from the last Government of India report quoted in your Review of last year. "The attempt to pursue these investigations" (*i.e.*, investigations into the economic and commercial value of minor products, etc.) "with the aid of a staff already fully occupied in the protection of the forests and in exploiting their major products must greatly restrict the sphere within which the Department has to confine its investigations, but with careful research, directed by men of experience and business capacity, it is probable that the true value of the various economic products of the forest will by degrees be ascertained and markets created for their disposal." In conjunction with this remark there was also a mention of the absence of a Forest Bureau of Enquiry and Investigation. We have looked in vain in the report under review for any further allusion to this important subject.

ÉCONOMIE FORESTIÈRE.†

A NEW FRENCH BOOK ON FORESTRY.

Mr. Huffel, of the Nancy Forest School, has just published the first volume of a new work on French Forest Economy, in which

* *Vide Vol. XXX, 1. p. 30.*

† *Économie Forestière*, by G. Huffel, Professor of Forestry at the Nancy Forest School, Volume I, published by Lucien Laveur, 13, Rue des Saints-pères. Paris.

the forests are considered from the point of view of human requirements and industries.

This first volume contains four parts—

- I. The Utility of Forests.
- II. Forest Properties and Forest Legislation.
- III. Forest Policy.
- IV. A Review of Forestry in France, and Statistics of French Forests.

Part I, on the Utility of Forests, is perhaps the most interesting part of the book for a non-Frenchman.

The first chapter deals with the various kinds of forest produce, both at home and abroad, and their importance, financial and industrial.

The second chapter gives a most interesting recapitulation of all the results of modern experiments and observations, both in France and in other countries, regarding the effect of forests on the climate of a locality.

The influence of forests on the temperature of the air and of the soils, on the hygrometric state of the air, and on the rainfall, is exhaustively dealt with, and the results of modern research in Europe on this interesting subject are very clearly set forth.

The third chapter is devoted to the influence of forests on springs and streams and on the subterranean water-level of a locality, and the results of all modern experiments and observations on these matters are plainly summarised.

A chapter on forests of protection follows, in which the utility of forests, and of artificial reboisement, in preventing torrents, avalanches, and moving sands, during the past century, is exhaustively reviewed.

The last chapter of this part of the book deals with the utility of forests as a means of obtaining revenue from waste, unculturable land, of draining swamps, of improving the atmosphere near towns, and of affording beautiful and beneficial resorts for the people.

Part II deals with the historical development of forest properties, whether belonging to the State, to village communities, or to private owners, and discusses the question of forest rights

A second chapter reviews the forest laws, ancient and modern, in France and in the French colonies.

Part III opens with a chapter on the taxation of imported timber and wood from the point of view of natural and political economy, and continues with a chapter on the responsibility of the State, and its right of interference in the working of forests in order to protect the general interests of the present generation and to ensure the welfare of future ones.

The third chapter of this part contains a very interesting historical review of the French Forest Service from the twelfth century up to the time of Bagneris and Broillard.

Part IV also opens with a chapter on the history of the forests of France from the earliest times up to the present day, and is followed by a general description of the principal forests in France, and their condition and value at the present time.

The last chapter is devoted to statistics of the forests and of the forest administration in France and in the French colonies.

We can confidently recommend this most interesting and useful book to everyone interested in forests, whether French or otherwise, and we look forward with a keen anticipation of pleasure to the publication of the remaining two volumes.

AN INTRODUCTION TO THE STUDY OF FORESTRY.*

This is a small pamphlet, evidently the work of a non-professional forester, recently published under the auspices of the County Gentlemen's Association, Limited. We welcome its appearance most heartily, since it marks a distinct step in the right direction in that it proves that the question of afforestation in Britain is making progress, and progress amongst the very class who can most assist the good cause. Sir Harold Hewett's little work does not pretend to teach the trained forester anything. It is chiefly a compilation based upon Dr. Schlich's "Manual of Forestry" and

* "An Introduction to the Study of Forestry in Britain," by Sir Harold G. Hewett, Bart., London. The County Gentlemen's Association, Ltd., 2, Waterloo Place, Pall Mall, W. Price 2s. 6d.

Professor Gayer's "Waldbaum." In his preface the author states his reasons for drawing it up. "There are several works on forestry in the English language, and from time to time fresh ones appear. The principles laid down by the various writers agree in the main, but the methods recommended differ so widely as to bewilder a beginner who is trying to study the subject by himself. The object of these papers is not so much to teach forestry as to give a beginner a shove, so to speak, in the right direction ; to criticise, compare and, when possible, to reconcile the advice given by the various writers ; to be, in short, nothing more than an introduction to the study of forestry."

"With all respect to our British foresters, it is assumed that the principles of sylviculture, as taught by Professor Schlich in his 'Manual of Forestry,' are sound." We professional foresters can assure Sir Harold and his readers that they will not be in any danger of going astray by their assumption.

Sir Harold begins by pointing out that it should be clearly understood that there are in Britain two schools of forestry—the old or British and the new or Continental. To the old school belong nearly all our writers, and most of our woods are worked on its system. The "Forester," by Brown, is still its standard work. In the host of other books one only need be noticed, "Practical Forestry," by Curtis, a second edition of which appeared in 1898. This book was written by a Professor of Forestry at Downton Agricultural College, and is laid down as one of their text-books by the Surveyor's Institution, and may be taken as representing British forestry up to date; it is worth a perusal as affording an interesting proof that the study of forestry in Britain is almost at a standstill. The 6th edition of the "Forester," edited by Nisbet, which appeared in 1894, may be said to mark the boundary between the two schools. In his preface Nisbet says it is an attempt "to engraft the modern continental science of Sylviculture upon the old British stock of Aboriculture." Sir Harold designates it a jumble of advice which is confusing to the beginner. We then come to the standard work in English, Schlich's 'Manual' of five volumes, the first two of which our author considers are sufficient

for the student to begin with. Sir Harold, after pointing out that the difference between the two schools is that the new one is scientific whilst the old one is not, then considers his subject under the headings Shade-bearing Trees, Choice of Species, Nursing, Thinning, Underplanting, The Density of Crops, Improvement of Existing Woods, a very important subject, Measuring Woods, ending with a few remarks on the subject of the necessity of every forester having a small handy book of tables, formulæ, etc.

Whilst congratulating the author on his interesting work we could wish that, in these days of cheap publication, he had found it possible to issue it at a lower price. In a second edition we shall hope to see it appear at a shilling, which would place it within the reach of a larger circle of readers.

SHIKAR AND NATURAL HISTORY NOTES.

A TRIP IN CANADA.*

THE LUMBER TRADE ON LAKE HURON.

BY COL. G. F. PEARSON.

Parry Sound is the great centre of the lumber trade on Lake Huron, and my old instincts have brought me here to see how they do things. Here conservancy is truly at a discount, or rather of no account at all. There are three great companies at work, all busily engaged in cutting up trees into planks and scantlings at a rate that can only be realised by those who have seen it. I have just been over the works of the Parry Sound Lumber Company, which are the most up-to-date, and do 140,000 superficial feet of sawing each day of 10 hours—partly planks, partly scantlings. I have never seen, either in the Black Forest or elsewhere in Germany or France, anything to approach their machinery for simplicity and practical efficiency. The whole is driven by a horizontal 750 h. p. steam engine, which works beautifully. The smaller pieces are cut up

* Extracts from letters written to Mr. Eardley-Wilmot, Inspector-General of Forests, which he very kindly placed at the disposal of the Hon. Editor.

by a series of parallel chain saws, which drag the logs in sheets against the circular saw. But the most marvellous piece of machinery I ever saw of the sort was the heavy steel table which carried the heavy logs and worked backwards and forwards against a huge saw, which ripped through them as if they were butter. Two men only stood on the table to work the levers; a log was brought in on a trolley dragged by a chain; it was rolled on to the table, gripped by the levers, the side slit off, turned over and squared, and finally cut up into planks or scantlings in far less time than I have taken to write this, each plank being thrown out and put aside much like the sheets of the *Times* are thrown out and folded in the *Times* Printing Office.

Just think of the destruction of forests at about a million feet of sawing per week in this mill alone, and there are three big mills here all going, besides smaller ones. It must be a thriving trade too. Just now all sections of the trade are working at high pressure, and good lumbermen—the experts at the work called “Gangers”—are earning 100 to 120 dollars a month, that is, about £20 to £25 a month. Ordinary lumbermen get commonly 30 dollars a month and their keep, which in the forest comes to about another 23 dollars a month. From this you may judge the importance of the industry, and of how little use it is to talk to people here about their real interest in conserving the forests as the richest capital in the country. They assent to this at once when you talk to them, but they say that present interests are too great to think of it. You might as well talk to the coal owners in South Wales on the subject of preserving their precious supply of steam coal, which is unique in the world. Government is powerless to interfere, as private interests are so strong and so many thousands of men get their living by the works in either case. But it seems to me a sad thing that nothing can be done to regulate this fearful expenditure of capital.

The lumbermen are a rough and hardy lot of men and work all the winter in the forests, as all the timber is brought to the river over the snow. The men who work in the mills at Parry Sound get 150 to 160 dollars a day and keep themselves,

which they do for 15 to 16 dollars a month, so their pay is about the same as the others—about 8s. 6d. a day. But they work ten hours for it, and work hard, which men won't do in England. Some of these men are wonderfully clever at their work, as I saw myself. You can hardly imagine what a rate the machinery moves at. As soon as the log automatically appears on the table, the man in charge has to estimate what it will cut up into, and as soon as the first side is ripped off, he sets the machine accordingly, and it is cut up. There seem to be few mistakes and no waste.

Sleepers, or "*ties*" as they call them here, are never sawn. They say they last twice as long if not sawn; they just take a tree about three-feet girth and cut it into lengths and roughly square it with an adze, and sometimes only just cut a place for the chairs.

The Manager of this great concern was a young fellow hardly over thirty, who had the direction of the whole works. He was most kind and civil, and a very clever intelligent man, full of interest in his own work and keen to hear about our work in India. I do not know what pay he received, but it was probably well over £1,000 per annum. He was a highly educated man, though he was dressed like and had the appearance of an ordinary lumberman.

The whole place is unique. It is like a typical backwood settlement on the shore of Parry Sound. All round, you may say for miles, you see nothing but lumber stacked up, which tugs and barges come to tow away; or it goes by rail from Rose Point close by. Most of the wood here is white pine, but there is a little red pine and hemlock.

Wood here is truly like gold and silver in the days of Solomon—"of no account." It seems to offend one's senses to see the waste. Walking round there are in every cove and every inlet and at every little stream hundreds and thousands of logs and even planks and scantlings in every stage of rotting away, and no one thinks it worth while to collect them.

There are a few good houses and stores, barber's shop, Methodist and Baptist chapels, etc., but most of the place is saw mills and rough shanties in which the lumbermen live. The Hotel

is quite a decent one, but very noisy, people coming in and walking about and having drinks and talking till after 1 A.M. at night.

To-day we go to Rose Point, which is a pretty quiet place round the corner of the Harbour, where they say there is a comfortable quiet hotel. Coming up here in the steamer from Pennetang on Lake Huron, which is about three hours by express train by rail from Toronto, I put up at a hotel on an island which belongs to (and the hotel is run by) Colonel Cautley, of the old 97th (now West Kent) Regiment. He is a grandson of Sir Proby Cautley, who built the Ganges Canal, and nephew of General George (Bengal Corps) and Colonel Dick Cautley, who used to live in the Dún. I spent three days very pleasantly there.

If you ever came this way I should advise your going to the Rose Point Hotel, a couple of miles off, a pretty quiet place, served by a launch which runs up the Harbour continually.

A DEAD ELEPHANT.

A letter in your number for June 1903 *re* a dead elephant has reminded me of a case I was unable to account for.

A timber working elephant on *must* and doing serious damage was shot in the hind leg. He was then fettered and turned into the jungle to recover, and after being there over a month was very nearly well enough to travel and get to work again.

The mahout saw him one evening, and next morning found him lying on his back, in a dry buffalo wallow, dead with his feet in the air and trunk spread over backwards as described in the letter referred to. No reason could be given for his death.

Unfortunately I could not get there in time for a *post mortem*, but up till the time of his death he had appeared quite fit and the wound was doing well. The wounded leg showed no signs of anything wrong and the bone was quite sound.

The only reason I could think of was that he had been sleeping by the buffalo wallow, had rolled into it and had not been able to right himself as his leg was still weak. In consequence he could not get off his back, and like a sheep when "cast" had died from the effect. Is this a possible explanation in this case and the case referred to in the former letter?

L. VALE BAGSHAWE,

Bombay-Burma Trading Corporation,

22nd October 1904.

Kindat, Upper Burma.

EXTRACTS FROM OFFICIAL PAPERS.

OBITUARY.

MR. J. MESSER, I.F.S.

It is with great regret we have to announce the death from blackwater fever of Mr. J. Messer, Deputy Conservator of Forests, Upper Burma.

Mr. Messer was appointed to the Indian Forest Service on the 1st January 1891, and was posted to Burma, in which Province the whole of his service was spent. He served both in Lower and Upper Burma, and was, at the time of his death, in charge of the Katha Division, Upper Burma, which, save for some six months' leave, he had held charge of for nearly seven years.

MADRAS FOREST MEMBER'S TOUR IN ANANTAPUR. *

Lord Ampthill, during one of his tours while Governor of Madras, was impressed by the prevalence of discontent with forest administration which existed throughout Anantapur and Kurnool districts. Mr. Sim, the Forest Member of the Board of Revenue, was accordingly deputed to tour through the two districts and

* These papers were kindly placed at the disposal of the Honorary Editor by the Board of Revenue, Fort St. George.

enquire more fully into the complaints received. The Government of Madras have now issued their resolution on Mr. Sim's detailed report of his tour in the Anantapur district, and a perusal of the report produces the impression that after all there were very few causes of complaint, and only such as could easily be remedied.

The district is typical of the dry inland part of southern India. Bare, dry and famine-stricken, it is studded with a number of isolated rocky hills, and surrounded on all sides by land which in a year of good rainfall is cultivated right up to the foot of the hills, but which in an unfavourable season remains uncultivated, giving rise to the impression that there still remain large tracts of waste land awaiting to be brought under cultivation. In such a locality reservation is necessarily confined to the isolated hills, and its necessity is emphasised by the general bareness and poorness of the district. Under such circumstances reservation and afforestation must inevitably be accompanied by some measure of inconvenience, if not actual hardship, to the villagers, which must therefore be endured with as good a grace as possible.

The growth on these hills is at present miserable. It will never be good, but should with careful management suffice to meet the every-day requirements of the agricultural population. The treatment indicated is simple, *viz.*, rest, absolute and protracted—no half measures will suffice; and with this end in view the suggestion to import fuel and small timber from the neighbouring district of Kurnool is very sound. The experiment was tried some ten years ago in Cuddapah district, where a lead of fifty miles by rail was found to be the maximum possible without the Department losing money on the transaction. The railway, however, did *not* give special rates; and it is very unlikely that they will do so now that their dealings with the Forest Department have been so much restricted by the importation of coal.

Complaints were common that reserve boundaries came too near to villages and cultivation, but such a state of affairs is met with all over India, and, provided reservation is confined to areas unsuited to cultivation, little can be done. The proposal to exclude small portions of reserves adjoining cultivation

in order to provide standing-room for cattle used in cultivating is a makeshift and not likely to be conducive to any good result. Either the cattle have standing-room outside the reserves, if that really is what is wanted, or they have not, in which case some much more drastic step is indicated than cutting out a few square yards as a cattle-stand.

The old standing question of unrestricted grazing comes up again, and it is satisfactory to note that the principle that any reserve can accommodate as many cattle as exist in the neighbouring villages has not been admitted. In Anantapur the cake has been eaten and only the crumbs remain. Until a fresh cake is made, the reserved areas will stand only the very lightest grazing, and a perusal of the report indicates this as the rock upon which the attempt to re-afforest the denuded areas may come to grief. If any good is to result, heavy grazing within the reserves must practically cease. It sounds a severe measure, but it is indispensable. The proposal to reduce the grazing fees, already very light, by one-third has not met the approval of Government, and another proposal to allow the issuing of half-yearly licenses, which has been sanctioned, will give much extra work, more opportunity for oppression, and is likely to only give relief in a comparatively few *bond-fide* cases.

Complaint was made of the absence of boundaries and the consequent accidental trespass into reserves. That boundaries should be clearly indicated is essential, but few Forest officers will be able to agree with Mr. Sim when he says "that a system of external and internal belts of live thorns, twenty or thirty feet wide, on the block-house system, and with openings only at recognised intervals, would go far to stop theft, trespass and fire." A fence absolutely impassable *throughout its entire length* is perfect. Anything else is worthless as regards keeping out would-be trespassers. No fence which can be erected in this country with reasonably limited expenditure is capable of remaining intact for long against the attacks of man and beast. Indubitably both man and beast will attack it, and the fence, instead of fulfilling the part it was meant to, will remain a monument of misdirected energy. We

put no faith in the moral effect of interrupted fences, and think that the instances quoted in the report as furnishing examples of the good effect of such fences can scarcely be relied upon as trustworthy. The fences referred to were low stone walls erected in the famine of 1876; they are by no means intact and offer no appreciable obstacle to the passage of either man or beast. The most reasonable interpretation of the fact that the growth within those walled areas is better than in the unwalled ones is that in 1876 walls were erected around the best and most promising of the reserves.

A proposal to remove unclassed forests from the control of the Forest Department and once more place them under the subordinate Revenue authorities has been negatived by Government. The proposal was based on the ground that such a step would free the villager from interference and annoyance, and enable him to get his wood and other produce under cover of "a simple form of permit, bearing the village officer's recommendation and the tahsildar's sanction." It certainly does not sound a very simple procedure, and makes one wonder what the unfortunate villager could do in the event of the village officer being loath to give a recommendation or the tahsildar his sanction.

Numerous other points are carefully dealt with in the report, which is interesting and valuable not so much, perhaps, on account of what has been achieved by the deputation of Mr. Sim to make the enquiry but as showing that many of the causes of discontent are beyond the reach of remedy for the present at any rate, others are trifling or imaginary, and the remainder are not of such grave importance as to have necessitated the special deputation of a Member of the Revenue Board. Every one of them would, we are of opinion, elsewhere in India have been dealt with locally as the result of a thorough inspection by the Conservator, who is essentially an inspecting and advisory officer, or failing this a useless luxury.

MISCELLANEA.

THE EVOLUTION OF THE HORSE.*

Professor H. F. Osborn referred to the three independent lines of research being carried on by Professors Ewart, Ridgeway and himself, and hoped that they would be able to bridge the interval which at present existed between the fossil, the historic, and the recent races of horses. He gave an account of the explorations, begun three years ago, of the American Museum, which were rendered possible by a liberal gift from the Hon. W. C. Whitney. The object of this search into the fossil history of the horse was to connect all the links between the Lower Eocene five-toed and the Lower Pleistocene one-toed horses, and to ascertain the relations of the latter to the horses, asses, and zebras of Eurasia and Africa. The first result obtained is the proof of the multiple nature of the evolution of the horse during the American Oligocene and Miocene periods. Instead of a single series, as formerly supposed, there are five—one leading to *Neohipparrison*, the most specialised antelope-like horse which has ever been found; a second, of intermediate form, probably leading through *Protohippus* to *Equus*, as Leidy and Marsh supposed; a third leading to the Upper Miocene *Hypohippus*, a persistently primitive, probably forest or swamp-living horse, with short-crowned teeth adapted to browsing rather than grazing and with three spreading toes; this horse has recently also been found in China. A fourth and fifth line of Oligocene-Miocene horses became early extinct. This polyphyletic or multiple law is quite in harmony with the multiple origin of the historic and recent races of horses as lately established by Professors Ridgeway and Ewart. The Pliocene horse of America still requires further exploration before it can be positively affirmed either that all the links to *Equus* are complete or that America is indubitably the source of this genus. The Lower Pleistocene of

* Abstracts of three Addresses given in Section D. of the British Association on 23rd August 1904;

America exhibits a great variety of races, ranging in size from horses far more diminutive than the smallest Shetland to those exceeding the largest modern draught breeds—yet all these races became extinct and did not survive into the human period as was the case in South America. The relations of these North American races to those of South America and of Asia and Africa is a subject requiring further investigation.

The address was illustrated by photographs of a large series of models, of osteological preparations showing the mechanism and breeds of the horse, and of the mounted fossil specimens recently discovered.

Professor Ewart referred to the fact that in pre-Glacial times there were several distinct species of Equidæ in the New World, and that one of the objects of the present inquiry is to connect the recent Equidæ with these or other extinct forms. Before it is possible to point out the connection between the true horses and the pre-Glacial or Pleistocene horses it is necessary to determine the number of species and varieties of the horse now extant. He described at some length Prjevalsky's horse, the Norse type of horse still found fairly pure in the north-west of Scotland, and the recently discovered Celtic pony. He referred to Prjevalsky's horse as the least specialised of living Equidæ, as evidenced by the character of its mane and tail and the presence of a complete set of callosities, and he discussed the question as to whether it is a mule or simply the offspring of Mongolian ponies run wild. The Norse type of horse differs from Prjevalsky's in its heavy mane and tail, finer head, and smaller ears. The Celtic pony is the most specialised of living Equidæ, as shown by the absence of such vestiges as fetlock-pads and chestnuts from the hind legs, and the presence of a peculiar tail-lock which adapts it for a subarctic habitat. Photographs were shown to illustrate these various features.

Professor Ridgeway then stated some of the evidence which led him to conclude that a distinct species or variety of the horse had been specialised in North Africa. Darwin supposed that not only was the Arab horse the result of artificial breeding by the Arabs

but that the dark colour of the English race-horse was due to the Arab dislike of light-coloured horses. History puts it beyond doubt that the Arabs had no horses at the beginning of the Christian era, and that they obtained their famous breed from North Africa; and so far from their disliking light-coloured horses, they have a predilection, on religious grounds, for white or grey horses, as had the Germans, Greeks, and Romans. Bay and other dark-coloured horses were well known in Northern Africa and Western Asia many centuries before the Arabs owned horses. The horse appears for the first time on Egyptian monuments about 1500 B.C., and is almost always painted brown, and those ridden by Libyans and depicted on pottery (at Daphne, B.C. 660—570) are always painted dark. These horses were not imported into Northern Africa from Asia; on the contrary, Solomon (tenth century B.C.) and his neighbours imported horses from Egypt, which must have been of a superior race. These horses were obtained from the Libyan tribes (as none of the other peoples in that region possessed them), and from them also came those of Southern Spain, the ancestors of the Andalusian and Pampas horses. The Libyan horses passed into Sicily and Southern Italy, and in the games of Greece and in Roman times they were the fleetest known. The bay horse therefore not only belongs to Africa from the earliest times but was then, as now, the swiftest. The Libyan horses show a greater tendency to stripes than do Asiatic horses, and the former often lack hock callosities, which are present and of large size in coarse Asiatic horses. The tail of the Libyan horse differs in structure, covering, and carriage from that of Asiatic horses; the hoofs are longer, and the neigh is different. Libyan horses were docile, and could be driven without bit, while the peoples who used Asio-European horses invented the bit. Professor Ridgeway concludes that *Equus caballus libicus* is to be regarded as a distinct variety.—*Nature*.

FORESTRY IN WALES.

The little Principality appears to be making more stir on the subject of afforestation than any other part of the country, although

there is evidence of a general active interest all round. On Wednesday, the 7th instant, a Welsh National Conference of Delegates appointed by the Welsh County Councils to discuss the question of afforestation in the Principality was held at Swansea, Sir Charles Philipps, of Picton Castle, presiding. The Chairman, in referring to the great importance of the study of forestry, said that the object of that meeting was to consider how best to advise the County Councils. After reference to the report of the Departmental Committee of 1902, the speaker said that there was in Wales an enormous area which could be profitably afforested, and pointed to the fact that afforestation gave employment to ten men where sheep farming would only give employment to one. It was necessary that professors of the subject should be appointed at the Universities, and that practical demonstration areas should be set apart. One of the latter had been already established on high meadowland in the Forest of Dean. The view was expressed by Mr. E. Robinson, of Boncath, in course of discussion, that the establishment of a central school of forestry for Wales was of the utmost importance, and that such a school would become self-supporting after a few years. It was at length resolved that the members should urge on their respective Councils the great importance of the study and practical application of forestry by providing lectures to be given at suitable centres and bursaries, enabling students to attend these lectures; also that a central school of forestry be established with example plants of three or more acres, and demonstration areas of suitable extent, and that the necessary expense be defrayed by the County Councils on the basis of their respective rateable values, the whole amount now asked for not to exceed £5,000. It was further resolved to communicate what was being done to the Government Department, in the hope that a grant from the State would be made towards their efforts.—*Timber Trades Journal.*

FROM TREE TO NEWSPAPER.—In how short a time a tree can be converted into a newspaper was found out recently at Eisenthal, in Germany. At 7-35 a.m. three trees were felled in an adjacent forest, stripped and taken to a local paper factory. By 9-34 the first sheet of paper issued from the machines. The printing works of the

nearest newspaper were four kilometres distant. The paper was carried there in a motor-car at full speed, the presses set to work, and exactly at 10 a.m. the newspaper was ready printed. The whole process from the forest to the reader thus only took two hours and twenty-five minutes.

THE COCHIN FOREST TRAMWAY.—The Cochin Forest Tramway is to be extended by twelve miles into Challacoody at a cost of Rupees two lakhs. The object of the extension is to avoid the delay and wastage consequent upon a process of floating the timber which it was originally intended to follow. By the extension of the tramway into Challacoody this difficulty will be entirely obviated, and timber can be brought down from the forest at any part of the season without waiting for the flooding of the rivers. After the proposed extension, the whole line of the Forest Tramway will cover a distance of forty-five miles, and Mr. Haffield, the Special Engineer, expects to complete the line before 1906.

THE TRANS-FRONTIER TRADE OF BURMA.—In the 'Record of the Trans-Frontier Trade of Burma,' a publication which was kept so heavily pruned during its compilation that much that would have been of the greatest interest and value to the reader has been left to such imagination as he possesses, we note that there is an increase of 22·49 per cent in the imports from the Southern Shan States, chiefly due to cattle, stick lac and timber; there was only a very slight increase in the export trade owing to diversion to the railway at Maymyo. There is very little doubt that the construction of a railway on this part of the frontier would result in a considerable expansion of trade, as means of transport are at present very deficient. The trade with Southern Siam showed the big increase of 279·52 per cent, the imports being chiefly cattle, elephants and silk piece-goods, and the exports jewellery and silver. The trade in elephants is probably a temporary one; there was a keen competition for them among Burmese merchants, but neither the supply nor the demand could be kept up to last year's figures for long. In Northern Siam also, where trade increased by 36·41 per cent, the chief items were cattle and elephants. The revival of trade with Siam is largely due to the tranquillity which

has succeeded to the recent unrest in Northern Siam. Both in connection with Siam and Karenne there was a falling off in the quantity of teak exported to Burma, but a large increase in value, teak being in growing demand, and much more difficult to obtain than was formerly the case. The Siamese forests are partially closed, and in Karenne there is more and more difficulty in extracting teak from the forests.

THE TIBETAN ANTELOPE.—Captain R. L. Kennion, writing in the *Pall Mall Magazine* for October, on the antelopes in Tibet mentions that not many years ago this particularly graceful beast could be seen in large herds in the Chang Chenmo and adjacent valleys of Ladak on the northern Kashmir frontier, but of late they have been driven eastward, till now they are scarcely found to the west of the Tibetan border, while to see them roaming the plain in any considerable numbers one has to travel far into the forbidden country, and reach a land inaccessible to all globe-trotters and unleisured persons. Everyone has heard how the Tibetan antelope scrapes for himself a hole in the ground, in which he lies so still that his long, slender horns look like dry willow shoots sticking out of the ground; and it was only this morning (says Captain Kennion) that my wife had pointed out with delight three little beds side by side in the sand—a big one, a smaller one, and a very diminutive one, evidently the resting-place during the night of some “papa, maman, et bébé” of the timid wilderness folk. Antelope are very pretty beasts, standing about thirty-two inches high. Their colour varies from brown to fawn, the under part being a lighter shade, almost white. Under the short, stiff hair lies a loose layer of wonderful soft white wool, which is woven into exquisite pashmina. This can be plucked out in handfuls, and is valuable. Their slender horns have a graceful curve, and frequently have a high polish in the natural state.

SCIENTIFIC TREE BUTT BLASTING.—Stately and well grown timber adds much to the grandeur of an estate, but nothing looks more untidy than a lot of old tree butts lying about, which often prove dangerous to horsemen and cattle.

The old primitive method of removing tree butts by grubbing, wedging, stocking or burying was tedious and expensive—the latter extravagant when firewood is taken into account.

The new system of blasting tree butts by electricity and "geligonite" (a safety explosive) appears, however, to be an efficient way of getting rid of these troublesome encumbrances.

Some very successful experiments in blasting butts have recently been carried out on the Right Hon. Lord Leigh's Stoneleigh Abbey Estate, near Kenilworth. The tree butts comprised elm, ash, alder and oak, some of the latter estimated (with earth attached) to weigh ten tons.

Mr. Thos. Johnson, of Kate's Hill, Dudley, attended to conduct the experiments. The last two butts to be taken in hand were elm of immense size lying close to the river, in the park. A hole $1\frac{1}{4}$ inch diameter was bored with a Gilpin auger into each of the butts; these being charged up with geligonite, an electrical detonator was inserted and attached to the main cable of the battery. All being ready, the operator retired some fifty yards away behind a huge oak tree, gave the handle of the battery a few turns, when the monster butt was blown into suitable pieces for loading up.

The work was done under the guidance of Mr. A. Wilson (Head Forester), and is regarded as a thorough success, and expeditiously carried out.

BIGGEST TREE ON EARTH.—The United States is, of course, a country of vast possibilities, but in the tree line, at any rate, we were under the impression there was nothing new to be discovered. Apparently in this we are wrong, as, according to a newspaper paragraph which is going the rounds, a well-known lumber mill man of Fresno, California, claims to have found a giant sequoia tree, 400 feet in height, and measuring 109 feet round the base. It is in a secluded gully in Tulare country, and is believed to be the largest tree on earth. We can only hope that it will be spared the woodman's axe.



Imperial College of Forestry, St. Petersburg, Russia.

INDIAN FORESTER

FEBRUARY, 1905.

THE IDEAL FORESTRY COLLEGE.

GENERAL REMARKS.

HAVING recently had the opportunity of visiting some of the best Forestry Colleges and Institutes existing in Europe, we have thought it might serve a useful purpose at the present juncture to give, within the limits of a short article, our impressions as to what an ideal Forest College or School should be, the said views being based upon a careful selection of the best points seen in the various institutions visited. That these deductions have had to be entirely drawn from continental experiences is due to the well-known fact that the British Empire is still without a representative Forest College, even the Forestry branch built up at Coopers Hill being now in the final stage of its existence. *In formâ pauperis* the Department now awaits the Government decision as to the nature of the establishment which is to rise on the ashes of Coopers Hill.

It is well understood that it is not essential that all forestry institutions should be equally provided for in the matter of staff and equipment, since their scope varies greatly; some are devoted to the training of the superior staff, whilst others concern themselves solely with that of the subordinate one. A primary object of all tuition given in a College or School which endeavours to inculcate the principles of forestry and forest work is that the greatest attention should be paid to training the powers of observation of the student to their highest possible pitch. That this should be done is needful for superior and subordinate alike: for the faculty of true and close observation and deduction from observation is the fountain head of all forest education. In all forest educational establishments therefore it is needful to supplement

the lecture room by the laboratory and the laboratory by the museum, and all three by liberal practical work in the field. Whilst the following article more particularly considers the arrangement and contents of the Forestry College required for the education of recruits for the Upper or Controlling Service of the Department, much that it contains will be found to apply to those institutions whose scope is limited to the training of the subordinate ranks.

In describing the requirements which we deem essential for our ideal College we will consider the matter under the heads of Situation, Buildings, Staff, Studies, arrangement of the main educational building (its libraries, lecture halls, laboratories, museums, Professors' rooms, etc.), College Gardens and College Educational Forests.

SITUATION.

The first question which arises in connection with the formation of a Forest College is its situation. It is necessary that it should be placed in the vicinity of wooded areas, and the more plentiful and varied are these latter the better for the purpose in view.

It should be possible for the student, within the limits of short walks, to study the commoner species of trees, shrubs and herbs, the zoological fauna, etc., with which he is beginning to make acquaintance, perhaps a first acquaintance, in the lecture room ; for under the present existing entrance examination for the Imperial Indian Service there can be no certainty that a forest probationer has even the most elementary acquaintance with Nature. To plant a Forest College in a flat, treeless country would be to damp the ardour of the student at the outset, just at the very period when it is most essential that it should be stimulated. Coopers Hill in England and Tharandt in Germany serve as excellent examples of what the environs of a Forestry College should be like.

BUILDINGS.

To be of the fullest use the College should be self-contained; in other words, not only the students but the major portion of the Educational Staff should dwell within the College precincts. For

this purpose several blocks of buildings are required. First and foremost comes the main educational building. This should contain, on a liberal scale, lecture halls, museums, laboratories and Professors' and Students' working rooms. In addition to the main building there would be, in the grounds, suitable quarters for the Director of the College, with separate blocks of quarters for the resident Professors and the students. It is better for these latter to reside in a building apart from the main building if feasible. In the grounds would also be situated a good gymnasium and open areas for recreation purposes.

STAFF.

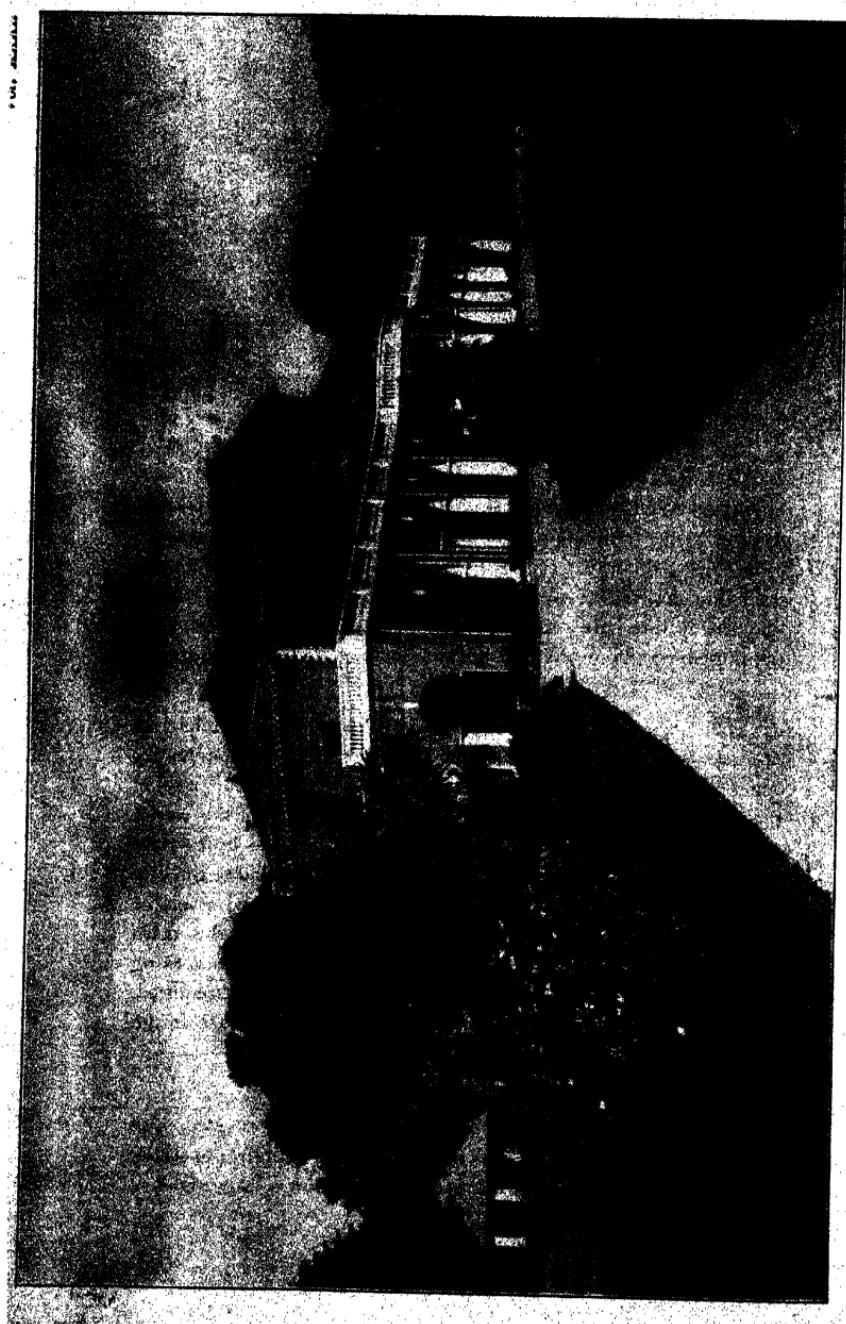
The question of staff is one which must ever be placed in the forefront where any educational establishment is under consideration, for efficiency is so often made subservient to a cheese-paring economy, and the finest College in the world is useless unless properly manned with the necessary number of Instructors. It is well understood that no one can teach with any degree of satisfaction or usefulness any subject other than his own, and this is perhaps more especially the case when the subjects are scientific ones. Both in the French and the British Institutions we have examples of a false economy necessitating the one Professor teaching both his own particular subject and one or more which he has had to 'get up' in order to lecture upon them. The students can easily distinguish between the two. The one subject they really learn something about. In the others *damnunt quod non intelligunt* very well expresses the attitude taken up.

In addition to a Director, who would be in charge of the whole institution, together with its instructional forests, we consider our staff requires nine Professors, who would deliver lectures in Forestry in all its branches, and Forest Law, Botany, Zoology, Chemistry, Surveying and Forest Mathematics, Geology, Mineralogy, Physics and Drawing. As examples of Colleges provided with such staffs we may instance Tharandt in Germany and St. Petersburg in Russia, the latter, however, owing to its much greater size has twelve Professors. Many of the Professors require assistants, who are responsible more or less for the museums, for the setting up of specimens, putting

them out for exhibition at lectures, and for assisting the students when visiting the museums out of lecture hours. In the German Schools we find that each of the Professors in Botany, Zoology, Chemistry and Physics, at least, is provided with such an assistant, whilst in the St. Petersburg Institute, where there are 500 students, all training for the Upper Controlling staff, there are no less than 15 assistants. The importance of having such subjects as (we of course need not allude to Forestry) Botany, Zoology, Geology and Chemistry taught by specialists in these subjects and of providing them, where possible, with assistants cannot be too strongly advocated. In Germany these latter are often students of the College who have finished their course but, having shown a special aptitude for some particular branch, are kept on a year or so longer; they will eventually either go into the forest or replace the Professors in their own or similar educational centres. Whilst this latter would not be feasible at present in the case of a British College, it would, we think, be quite practicable to keep on a promising student for a couple of years or so, allowing him to draw the pay and allowances of his rank, whilst thus qualifying himself as a specialist in his particular branch. The work such a man would do when he eventually joined the Department would well repay the extra educational advantages afforded to him, whilst he himself would be of the greatest use to the students in residence during the years of his extra deputation.

CURRICULUM.

There is little necessity for considering here the subjects which it is essential for the future Forest Officer to study at College: they are well known. There are, however, two points which may with advantage be touched upon. The first is connected with the knowledge possessed by the student when he first enters the College. Few who have studied the question at all can doubt that he should come in with an elementary knowledge of Botany and Applied Science, including an elementary course in Zoology and Anatomy. Further, that he should have a liking for scientific subjects. That a student entering a Forestry College with a knowledge of classics and perhaps of modern languages only is more



than likely to prove a lamentable failure as a Forest Officer will perhaps surprise but few save the Public School Master. The second point more particularly applies to our British Schools of Forestry, and it concerns the instruction given in the subject of Forest Zoology. The importance of this branch of the work has had but little recognition, and the tuition in it has been of so inadequate a nature as to preclude the student from attaching to the subject in his after service the importance which it undoubtedly deserves, and which it receives in Germany, France, Russia and Austria.

THE EDUCATIONAL BUILDING.

We will now consider briefly the arrangement of our main building. We have already seen that it will consist of libraries, lectures halls, museums, laboratories, Director's and Professors rooms, etc. Following the plans of the best continental Colleges, the rooms devoted to special subjects will be arranged in suites so that the lecture hall appertaining to a particular subject will have the museums, laboratories, etc., of that subject contiguous to it.

THE LIBRARIES.

The general library of the building will contain a complete set of works on Forest subjects, both in the language of the country for which the College serves as an educational institution and also in those of all the important forest-conserving countries of the world.

That such a library should be as extensive and as up to date as possible would be a *sine qua non*. This library would be directly under the administration of the Director, but would be available daily to professor and student alike. In addition to this main library each professor would have his own special one in his working room, containing such works of reference as he constantly required. All more costly and rarer works would find their place in the general reference library.

THE LECTURE HALLS.

In so far as practicable each subject should be provided with its own lecture hall, and this more especially applies to those subjects in which the lecturer requires to show a large series of

specimens during the delivery of the lecture or to prepare series of experiments. Thus, for example, separate lecture halls should be provided for such subjects as Botany, Zoology, Chemistry and Physics, to mention a few. Where, through economy, it becomes necessary to use the same lecture halls for several subjects, the different lectures, coming one immediately after the other, necessitate the professor curtailing the number of his exhibits owing to the impossibility of getting them into the hall and arranging them in time for the lecture. This in itself, since it is a disadvantage to the student, is a sufficient plea for the necessity of separate halls. Where possible the lecture halls should be so disposed that they may open out on the one hand into the museum devoted to the particular subject and on the other into its special laboratory.

THE LABORATORIES.

It is scarcely necessary here to dwell upon laboratory requirements. There are few branches of science in which a laboratory or practical working room is not an essential part of the instructing staff's equipment. For convenience it would be so arranged as to be contiguous, or as adjacent as possible, to both museum and lecture hall. In the German Schools separate laboratories are provided for Botany, Zoology, Chemistry and Soils, and Physics.

THE MUSEUMS.

In all educational establishments where any subject which treats of the constitution of the world we live in, its structure and rocks, its fauna and flora, etc., is dealt with, a first desideratum is a good Museum. But although latterly this has come to be recognised to a certain extent in the British Empire and has long been fully understood by the more enlightened continental nations, the object in view is often defeated by the internal arrangement of the museums. It is considered that all that is required is that collections should be made or bought and placed in the room or rooms set aside for museum purposes, without any particular attention being paid to the proper grouping together of the various objects exhibited. For instance, a collection of butterflies will be

shown alongside specimens of pickled fungi; jars of pickled fish mixed up with lizards and scorpions, also in spirits, whilst a series of spirit specimens of beetle and moth larvæ will be placed amidst a collection of mineralogical and fossil specimens. To the student new to all these various objects their appearance leaves but a confused jumble of objects on the brain without the possibility of his acquiring a true knowledge of their proper place in Nature's Kingdom. Even the more experienced worker cannot but find his attention wandering when, wishing to study botanical specimens, he finds them mixed up with zoological or mineralogical ones. For a Museum to be of real service it is absolutely essential that each of its branches which deals with a special subject such as, e. g., forestry, botany, zoology, mineralogy, chemistry, physics, etc., should be kept distinctly apart. In our College we would have separate rooms or suites of rooms for each branch. If it is possible to so arrange that each Museum is contiguous to the lecture hall and laboratory to which it belongs, the ideal will have been attained ; this latter exists in the Tharandt, Munich and St. Petersburg Forest Colleges. Coming now to the subjects which should be given separate Museums in, if possible, separate rooms (if the latter is not possible some method could be easily devised to sharply mark off each separate branch so as to avoid all chance of confusing the student, provided that sufficient space is available), we have the following list :—

1.—*Forest Woods (including forest fungi and examples of hypertrophy).*

A complete set of specimens of the woods of the country would be shown both in the form of hand specimens and in larger blocks so that the student could come to recognise the appearance of the wood in bulk ; these large pieces would have the bark on one side in order that the student could become familiar with its appearance. A collection of the commoner forest fungi and examples of hypertrophy in woods would also be included here for the use of the Forestry lecturers on these subjects.

2.—*Forest Instruments and Models.*

This collection would be made as complete as possible, but

it would not be necessary to include in it inventions which have not come into practical use in the forest. The number of such is already too large to prove anything but confusing to the student. The collection of models would to a certain extent depend upon the configuration and forests of the country for which the Museum is being made.

3.—*Forest Wood Craft.*

A complete set of shooting and hunting implements would be shown, special attention being made to exhibiting those in use by poachers in the forest areas so that the student might become acquainted with their appearance. The different kinds of bullets, sizes of shot, and the various animal traps, fish traps and nets, etc., would also be shown. Further, a complete set of the slots of the animals common in the forests of the country would be prepared for the student's use. These can be easily made by taking or obtaining impressions of the foot-marks in sand mixed with a certain amount of gum. This Museum might be included in the Forest Instruments Museum or be placed in No. 4.

4.—*Forest Products Museum.*

In this Museum would be shown all the minor products which the forests produced, as also examples of the various ways in which the various woods and products were used, such as, e. g., joinery, agricultural implements, wood toys, tannins, fibres, lac, dyes, etc., etc.

5.—*Botanical Museum.*

This Museum would contain a set of hand specimens of the woods of trees and shrubs and a series of the fruits and seeds of trees, shrubs, and herbs; specimens of tree and plant fungoid diseases and examples of hypertrophy. Also a herbarium and, if considered useful, some models showing the structure of the different parts of plants. Also a complete set of fibres.

6.—*The Zoological Museum.*

This would be divided into three parts. The first would comprise a complete collection of objects to illustrate the lectures given on the Animal Kingdom as a whole, only representatives of each class or group being exhibited. The second part would show

a representative collection, named throughout, of all animals to be met within the forest areas proper, in open woodlands, grass lands contiguous to forests, in fact all the animals which the Forester is likely to meet with in the course of his daily work. The third portion of the Museum would be the Economic Section. In this would be set up as far as possible in a life-like manner all the pests destructive to forests ; examples showing the method in which the damage is done would be shown with the specimens themselves. When the animals themselves are very small, enlarged drawings would be shown alongside in order that the student might make himself acquainted with the aspect of the particular pest. The best Museum we know of this nature is Dr. Pauley's Zoological Museum at the Forest branch of the Munich University.

7. *Chemistry and Soils and Rocks.*

A representative collection of the various soils of the country would be shown in small tin boxes arranged in sloping desk cases. Above each soil would be exhibited in a glass picture frame a dried mounted specimen of the plant or plants most characteristic of that soil. A collection of characteristic rocks would also be shown here. In the best German Schools the apparatus used for soil analysis is also exhibited, and the students are shown how a soil analysis is carried out.

8. *Geology Mineralogy and Fossils.*

Collections of the various minerals, precious stones, ores and fossils are shown in this Museum.

9. *Surveying.*

A collection of all the surveying instruments used in the surveying course given to the students is kept in a separate Museum to which they have access in order that they may make themselves thoroughly acquainted with these necessary adjuncts to their work.

10. *Physics.*

All the physical apparatus used in the lectures is kept in the Physical Museum or Laboratory as it is usually called.

Museums on some such lines as laid down above will prove of the greatest service to professor and student alike, and their

formation and upkeep is a first desideratum of our Forestry College. The tending and upkeep of some of them becomes a serious consideration. Additions are constantly coming in and require to be set up; specimens require renewing, and there is a large amount of supervision constantly necessary. This is the work which falls to the assistants in the German and Russian institutions, and it is the absence of such assistants which has resulted in the Nancy Forest School Museums falling behind the high standard maintained by the others. At our British Imperial Forest Schools we would like to see this question of proper museums taken up in a thoroughly efficient manner. Owing to a false economy in past days they are admittedly far below the standard we have given above for our ideal College, and this ideal is by no means unattainable as is demonstrated by the continental Schools.

THE DIRECTOR'S, PROFESSORS' AND ASSISTANTS' ROOMS.

In addition to the rooms set apart in our main building for the Director and his assistants or clerical staff, the continental Schools recognise that each professor requires a separate working room in which he can prepare his lectures, keep his more valuable specimens, his special library and carry on his researches out of actual lecture hours. This room should, if possible, form one of the general suite devoted to his own branch of instruction, and would communicate with his assistant's room should he be provided with one.

As an illustration of the above remarks we may describe here the suite of rooms devoted to Botany at the Munich Forest College. Two rooms are devoted to Plant and Tree diseases, the collection being a complete European one. A third room contains a series of exhibits of the seeds and fruits of plants arranged in glass cases, also a set of fibres. A fourth small room contains a large series of portions of branches and stems of trees showing the results of lightning strokes and the effects of electricity on the wood. This has been arranged by Prof. Tubœuf himself, who is making a speciality of this study. A fifth room contains a collection of the woods of forest trees, the specimens being used to illustrate the botanical lectures. This series of rooms forms the Museum proper. We then come to a magnificent botanical laboratory containing

every facility for study and research. This contains a collection of tree fungi in spirit in a glass case, the herbarium and a number of other objects on which research is proceeding. The laboratory opens out into a conservatory, where various experiments in connection with growth were being carried out at the time of our visit. Students who show promise are encouraged to work in the laboratory. Next to this latter are the professor's and assistants' rooms, both well fitted with appliances, the former with a good botanical library. Beyond these again is a fine lecture hall. This latter is confined entirely to the botanical lectures, the walls being hung with diagrams of dissections of plants, picture frames containing young dried plants with their root system attached, etc. In addition there is a workshop room for packing and unpacking specimens sent out and received from the forests, and finally a dark room for photographic work. This completes as fine a series of rooms devoted to one important branch as can be desired. Above in the same building is another series, no whit inferior, devoted to Zoology.

STUDENTS' WORKING ROOMS.

Since the lecture halls are each reserved for special branches of the course, and are therefore not available for the students' use save during lecture hours, it is necessary to provide the latter with rooms in which they may study at hours when it is not convenient to them to retire to their private quarters. For this purpose we would set apart special working rooms in the main building, one being confined to each 'year' or promotion of the students. Whilst such rooms will prove of great benefit to the students themselves, they are also of use to the professors, who are able to set up or hang up specimens or diagrams which they have been exhibiting in the lecture rooms. These are changed at intervals as the lectures demand, and in this way the student has constantly before him exhibits bearing upon the subjects he is reading about at the time. A simple wall rack will enable dried specimens of plants or diagrams to be slipped in and locked in in safety, whilst a sloping desk rack enables cabinet drawers to be slipped in and exposed in a similar manner without danger to the specimens.

By the provision of students' common working rooms a privacy is guaranteed which cannot be obtained in the public lecture rooms, these latter becoming little better than lounging places or passages if used for this purpose.

Our College would of course require the usual bursar, store-keeper and curator, porters, etc.

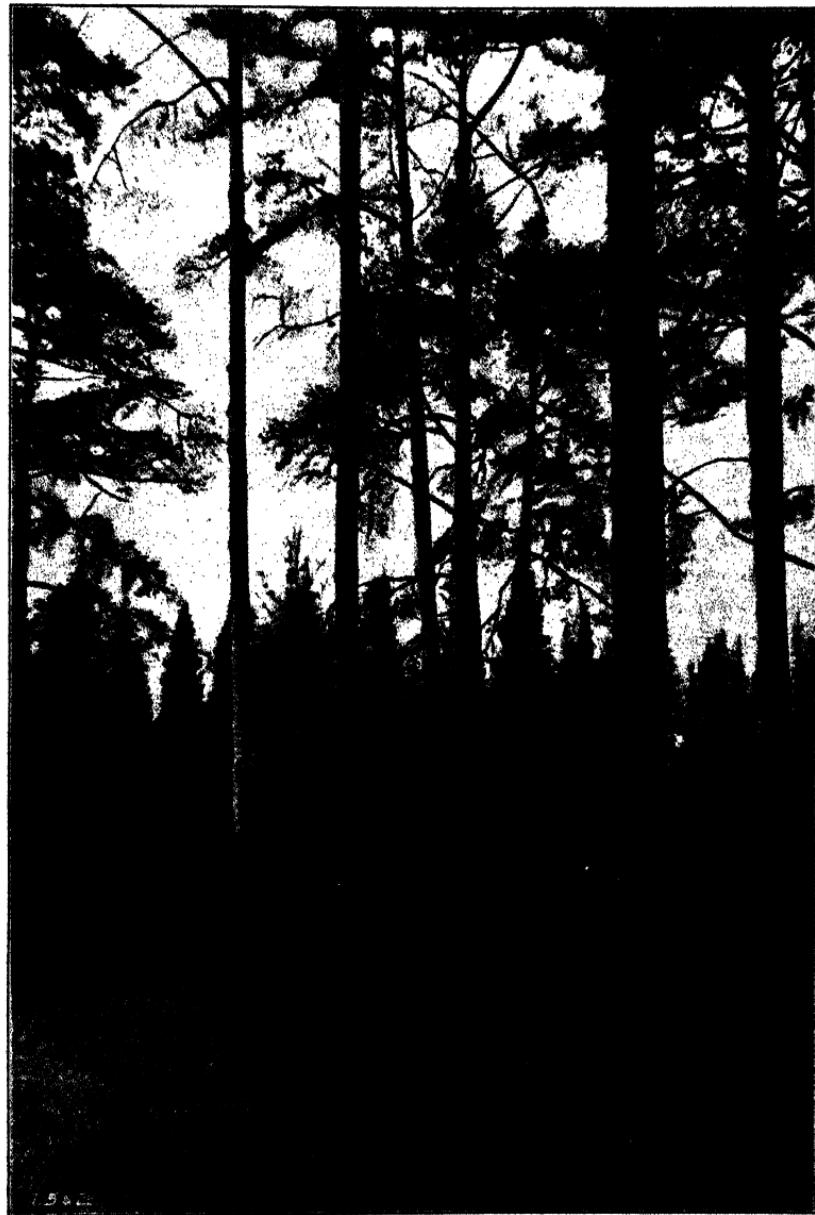
Leaving the College building, we now come to a consideration of what is required for the practical demonstration work in the field, which forms so essential a supplement to the theoretical work in the lecture room.

THE COLLEGE GARDENS.

As an example of what a Forest College Garden should be we cannot do better than instance Tharandt. Situated on the side of a steepish hill, several acres are devoted to the growth of trees, indigenous and exotic, shrubs and herbs. The garden is so planted that the species are more or less arranged in their natural orders in the beds, and in addition to containing all the cultivated herbs and perennials, areas are allowed to run wild and fill themselves up with wild flowers and weeds. Every tree, shrub and plant is named, its order, Latin and popular names being attached to the label. Here the student may come and study pure Botany as taught by his botanical professor or follow the forest lecture course of forest botany with ease and profit. The greatest trouble has been taken to introduce exotic trees, with the result that a very fair knowledge may be obtained of trees other than the ones belonging to his native country. Such a garden requires constant attendance and constant additions, and in it the student should be, and is, allowed to roam at will. In addition to the botanical garden and arboretum space is also devoted to a forest nursery in which young trees of many varied species are reared. In this the student is shown, and can study for himself, exactly how the young trees, which are at a future date planted out in the forest, are grown. The forest nursery forms an important part of the forest garden.

THE COLLEGE FORESTS.

We hold the opinion that to every Forestry College some



Large Birch Trees in the grounds of the Imperial College of Forestry, St. Petersburg.

forest areas should be attached for instructional purposes. This is usually the case on the continent, and as instances we may quote the Tharandt and St. Petersburg College Forests. In each case considerable areas are attached to the institutions and they are placed entirely under the Director of the College. Although a satisfactory revenue is obtained from these forests, this latter is entirely subordinated to the chief object for which they are kept up, *i.e.*, that of forming instructional centres for the use of the students. Perhaps nowhere can such forests be seen to better advantage than in Tharandt, where considerable sums of money have been spent with the sole object of providing the best possible training ground for the embryo Forest Officer. They have here ideal students' forests, abounding with almost every species which grows in North Europe. The College forests should be managed by departmental officers directly subordinate to the Director.

These College Forests, however, are not sufficient in themselves for the instruction of the students. For their longer tours and final practical course a further set of forest areas should be carefully chosen, and for this purpose we think the Russian plan has much to recommend it. M. E. Kern, the gifted Director of the St. Petersburg Forest Institute, has adopted the following plan : One hundred and fifty forests were carefully selected from the great forest areas of the country as affording special advantages for training purposes. Only fifty of these forests are visited in any one year, and this procedure minimises the extra work and trouble which the advent of forest students into a division must inevitably throw upon the divisional staff, since the invasion only occurs once in three years. Of course, the staff in charge of these forest areas are in no way subordinate to the Director. A further improvement of Director Kern's is that the students work in the forests in pairs from the very outset. Throughout the whole of their four years' course they are never taken about in bands. The great advantage of this plan will be obvious to all who have had practical experience of how much is assimilated during the tours conducted on the 'troop' system.

SCIENTIFIC PAPERS.

THE INSECT PESTS OF SWIETENIA MACROPHYLLA.

BY P. M. LUSHINGTON, I. F. S.

THE growth of *Swietenia Macrophylla* in Nilambar is so remarkably rapid that, were it not for its numerous enemies, its introduction would be an undoubted success. There is only one really big tree which is found in the middle of teak planted in 1872, which has a girth of 82 inches and a height of 95 feet, but there are many trees of good growth, notably some of 12 years old, which have reached a girth of between 5 and 6 feet and which are yielding good seed. Unfortunately, in its early years, the spotted deer browse down any seedling of this species that they can find, whilst the sambhar pick it out as a suitable tree on which to rub their antlers. Protection against enemies of this nature is however not difficult, and though this considerably adds to the expense of introduction, yet it is effective. It is, however, almost impossible to protect it against insects, whose injuries to the tree have to be seen to be believed. Not only do these insects kill off the younger plants, but I have seen well-established trees of 4 feet in girth completely killed by them, whilst even in bigger trees large branches are killed out. A study of these insects seems therefore very desirable, and anything in the way of identification may lead to a possible means of extermination. Defoliation of the young plants is fairly common, and the cause seems to be a buprestid beetle, which I have found in great numbers. Specimens of these are being identified by the Government Entomologist. More serious damage seems to be done by an insect which I have been unable to discover. This attacks the leaves, but more especially the midrib and sometimes the young shoot. The parts attacked turn brown and on the midrib and shoots a scar is left, and the woody portions become subsequently affected. I am inclined to suspect that this damage is done by a small beetle allied to the Rose beetle, for, though I have never found this on the mahogany, it is plentiful

on the neighbouring blackwood trees, where it damages the flowers and flower-stalks in a similar manner. I notice that it emits a black fluid, which appears to be injurious to the leaves. Far more serious is the damage to the leaf-buds. The leaf-bud is completely eaten away, and the insect then appears to tunnel into the twig. Innumerable instances of this kind of damage are to be found, but none of them of recent origin. From the damage done, which is exactly that described by T. S. G. in the *Indian Forester* and quoted by Mr. Stebbing on page 123 of his "Injurious Insects," I am inclined to suspect the *Magisia (Hypsizyla) robusta** as the cause; more especially as I see that damage to mahogany by this insect has been reported from Nilambar. Apart from these, however, there is a serious attack going on now which is evidenced by the leaves dying off suddenly on considerable-sized twigs. This damage is not due to any of the insects noted above, but a careful search has revealed three species of Bostrychid beetle. Of these by far the worst is a small brown Bostrychid, which enters the twig at intervals of two or three inches apart; a deep tunnel is then grooved out all round the outer part of the twig, which is almost invariably lined with a white substance. This girdling of the twig, inside the bark, appears to make the woody portion of the twig accessible, for the subsequent tunnellings are made into the wood itself, and the eggs deposited in them, and these galleries are also lined with a white substance. This appears to be nutritious, because when the young are hatched it seems gradually to disappear. The young consume the wood in all directions and render the twig quite hollow, and when they have left, these hollowed-out twigs afford refuge to ants, small bees and a variety of insects. I specially noticed one large tree which had not less than fifty twigs killed off in this manner and a few fair-sized branches. The beetle itself is very minute, not more than $\frac{1}{5}$ th of an inch in length. Very similar damage is done by a larger black Bostrychid, whose borings are fairly numerous and also white-lined, but I have only found one specimen of the perfect insect and one specimen of

* In a subsequent letter Mr. Lushington informs us that he has procured specimens of this insect and was able to identify it as being the pest.—HON. ED.

what I believe to be its larval form. The third species is another minute black Bostrychid which seems to work in conjunction with the brown one. It is very numerous, but does not seem to have the power of girdling which the brown one possesses and penetrates directly into the wood. Its galleries are not lined, and I believe the damage done by it would be insignificant but for its habit of working in conjunction with the brown species. Altogether this tree seems to be a perfect repository for insects, and, being a valuable one, seems to demand the attention of the Forest Entomologist.

Having recently received specimens of the insects alluded to by Mr. P. M. Lushington in the above paper I have been able to make a few preliminary identifications and observations upon them :—

The Buprestid beetle is *Psiloptera fastuosa*. This insect has been previously reported from Nilambar as injuring the teak plantations by boing into the wood, presumably in its larval state (*vide* 'Injurious Insects,' p. 39). Should Mr. Lushington be able to corroborate this observation it will tend to prove that the planting of mahogany with teak is directly in favour of the beetle.

The beetle considered as allied to the Rose beetle, and reported as damaging the flowers and flower-stalks of the Rose wood (*Dalbergia latifolia*) is a species belonging to the genus *Serica*. Several other species of this genus are now known to commit damage in this way, and it is probably one of considerable economic importance in India. It is not at all unlikely that the species here alluded to also attacks the mahogany, and it will prove of interest if Mr. Lushington can prove that this is the case.

The life-history of the tun bérér (*Hypsizyla robusta*), as far as it is at present known, is described in Departmental Notes on Insects that Affect Forestry, No. 2, p. 312.

The beetles alluded to as Bostrychids are three species of the bark and wood-boring family of *Scolytidae*. The small brown one girdling the twigs is a species of *Xyleborus* or a closely allied genus. The damage done by this pest appears to be very considerable.

The large black insect is a species belonging to a genus about which little is known in India. The larva supposed to belong to this insect, belongs to quite a different family, the true Bostrychids, *Bostrychidae* (for the difference *vide* Vol. XXIX, No. 1, 2, of this Magazine), it being provided with three pairs of legs, one pair on each of the three segments following the head. This larva may prove to be that of a species of *Sinoxylon*.

The third beetle mentioned is probably a species of *Tomicus*, a wood-eating genus of the *Scolytidae*.

Mr. Lushington's note is a most valuable one, and I trust he will continue his observations. During ten days spent at Nilambar towards the end of August 1902 I found a grub of a weevil boring galleries in the succulent bark of the mahogany trees in the Aravallikavu Plantation. These galleries penetrated down to the sap wood. One two or more galleries take off from an irregular shaped central chamber.

The attack can be recognised externally by a flow of gummy matter which exudes from the attacked area and drips down the outer bark, coagulating in irregular-shaped sticky masses. These evidences of the presence of the grubs in some numbers were visible upon the main stems and also on the larger branches. I procured some specimens of the grubs and pieces of bark, but the latter dried up and the former consequently died before pupating; the mature insect has not yet been procured.

In addition to the attacks of the larva of the moth *Zewsera coffeeae* (*vide* 'Injurious Insects') young saplings also have to fear those, which are probably by far the most important, of a longicorn borer, only the grub of which is at present known. I was able to see the evidence of these attacks in the interior of the wood of some trees which were split up. It is very desirable that the life-histories of both the weevil and the longicorn borer should be worked out.

I trust to be able to furnish a further note on the *Scolytidae* when I have more fully studied these pests.—E. P. STEBBING.

ORIGINAL ARTICLES.

JOSEPH MESSER, I. F. S.

Before these pages appear in print many of our readers will have heard of the sad death of Mr. Joseph Messer, from black-water fever, on the 25th November 1904. Taken ill on tour, he was brought back, in a very serious condition, to Katha, in Upper Burma (where he had been stationed for over seven years), and expired two days later.

Mr. Messer was thirty-five years of age and had nearly fourteen years' service, having reached Burma on the 1st of January 1891. For the first five and a half years of his career he was mostly employed on Working Plans. In July 1896 he took furlough for fifteen months, and on his return in October of the following year was gazetted to the charge of the Katha Division, and, with the exception of six months' leave in 1902, he remained in charge of this Division till his death.

When Mr. Messer first took charge of the Katha Division it had a most unenviable reputation for fever and was justly regarded as a penal settlement. Although the Division had been eleven years in existence, forest work was still in its infancy, and Mr. Messer had a wide field in which to exercise his remarkable

faculties for organisation. The northern portion of the Division has been lately formed into the Myitkyina Division, but since the separation of the latter but little has been done, so that in estimating the progress that was made under Mr. Messer's efficient administration it is only fair to take the combined figures for the two Divisons. During the seven years 1896-97 to 1903-04 the area of reserves increased from 420 to 758 square miles and the area under fire-protection from 320 acres to 554 square miles. The revenue increased from Rs. 1,39,073 to Rs. 6,15,892; the expenditure from Rs. 56,033 to Rs. 1,91,918, and the surplus from Rs. 83,040 to Rs. 4,23,974. This is a splendid record for any Division, but it by no means represents the full value of Mr. Messer's fine work. He was a great believer in fire-protection, as the above figures show, and he had hoped to protect every acre of his reserves in another two years; but he also believed in creeper-cutting and works of improvement going hand in hand with fire-protection, and he expended much energy in these necessary operations. All creepers have been cut over nearly the whole area of his reserves, and works of improvement to free the young teak have been started in almost every reserve and are being pushed forward as fast as the limited staff will allow.

But it is probably in connection with the experiments for the natural regeneration of teak that Mr. Messer's name will be chiefly remembered. Full details of these have already been published, but, briefly, Mr. Messer ascertained that by merely cutting the low brushwood in the neighbourhood of seed-bearers and burning it plentiful natural regeneration was induced, and that by a further burning the second year results equal to those of a first-class taungya were obtained at a nominal cost. The full value of this discovery cannot yet be estimated, but if the simple procedure is found suitable for all classes of teak forest our expensive system of taungyas and regular plantations will be a thing of the past, and we shall obtain better and more natural results at a fraction of the cost, whilst being able to deal with far larger areas.

Mr. Messer was a most hard-working and keen Forest Officer with the soundest views on technical matters, and his death will be

a severe loss to the Department. His life's recreation was his work, and outside of this he had few interests. He understood the Burman thoroughly and could get good honest work out of the most unpromising material. He had been so long in one Division that he *knew* his men as it is given to few Forest Officers to know them ; he was honoured and respected by all with whom he came in official contact, and his death will be greatly felt.

Mr. Messer leaves many sincere friends to mourn his loss. His kind, sympathetic and genial nature had endeared him to them, and on all sides are heard expressions of deep regret at his sudden death.

The value of his work was recognised outside his own Department, for, on learning the sad intelligence, His Honour the Lieutenant-Governor of Burma had the following telegram despatched to the Conservator of the Circle in which Mr. Messer had been serving :—

"The Lieutenant-Governor desires me to say that he is deeply grieved to hear the sad and unexpected news of Mr. Messer's death. The Government have lost in him a very valuable Officer, who had earned for himself a high reputation and whom they can ill-spare. Sir Hugh Barnes asks that his sincere sympathy may be conveyed to Mr. Messer's family."

We can only endorse this kind and sympathetic message.

NURSERY TREATMENT OF DEODAR IN JAUNSAR.

1. *Collection of Seed.*—The seed is collected from sound, vigorous trees in October-November as soon as the cones are ripe. Fresh seed is gathered every year for sowings, as the seed rapidly goes bad and cannot be stored for more than one year.

2. *Site for Nursery.*—A. N.-E. or N.-W. aspect is preferred with a water supply near at hand. Whether watering will be necessary or not depends on the locality and season.

3. *Preparation of Seed Beds.*—The soil is thoroughly worked to a depth of about 9" and good humus soil is mixed with it. The

beds are made $2\frac{1}{2}$ " wide and are raised about 4" above the surrounding level of the ground.

4. *Watering*.—Watering may be necessary in the dry months preceding the rains. Water is run into trenches alongside the beds and allowed to percolate through them without flooding them.

5. *Season for Sowing*.—The best season for sowing is November-December soon after collection of the seed and just before the snow falls. Sowings may, if necessary, be made early in the spring, but they do not give such good results as the winter sowings.

6. *Method of Sowing.*—The seed is sown in rills 3" apart across the width of the beds. Where there is fear of drought, especially with spring sowings, it is an excellent plan to cover the seed beds after sowing with moss, which may be pegged down to prevent its being blown away.

7. Treatment of Seedlings in the Nursery.

(a.) *Ordinary method.*

- November-December Seed is sown;
 Spring (March-April) Seed germinates.
 1st July (7 mos. after sowing) ... Seedlings pricked out 4"×4" into other beds.
 2nd " (1 yr. 7 mos. " ") ... " " " 6"×6" " "
 3rd " (2 yrs. 7 mos. " ") ... " " planted in the forest.

(b), *Basket plant method,*

- | | | |
|--------------------------------|-----|---|
| November-December | ... | Seed is sown in nursery beds. |
| Spring (March April) | ... | Seed germinates. |
| 1st July (7 mos. after sowing) | ... | Seedlings pricked out into baskets. |
| 2nd , (1 yr. 7 mos. ,) | ... | " left undisturbed in their baskets. |
| 3rd , (2 yrs. 7 mos. ,) | ... | " planted in the forest in their baskets. |

This method of using basket transplants is by far the best. The plants are usually stronger and healthier, because they have been less disturbed; but their chief advantage lies in the fact that they can be put into the forest with the minimum risk of damaging the roots.

The baskets are made of the small hill bamboo (*Arundinaria falcata*) called locally "Ringal." They are of cylindrical shape about 9" high and 6" diameter, and cost about one rupee eight annas per 100.

Transplanting in the Forest.—Holes are dug 18" deep by 12" diameter at distances 4' × 4' from centre to centre, and the planting is done just before the rains commence. Fig. 1 illustrates this

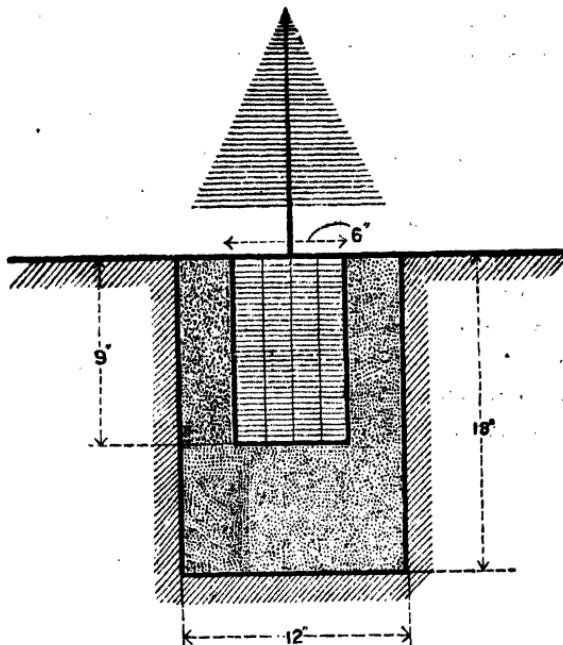


FIG. 1. —METHOD OF PLANTING OUT BASKET-TRANSPLANT.

method. N.-W. and N.-E. aspects are the best and the soil most preferred is a light rich moist one with good drainage; on hot aspects the transplants require protection.

Cost of formation of one acre of plantation at an average distance of one mile from the nursery.

	Rs. a. p.
Sowing and tending in the nursery for 2½ years	... 3 8 5
Price of 2,822 baskets at Rs. 1-8 per 100	... 42 5 3
Digging holes 18" deep × 12" diam. at Re. 1 per 100	... 55 2 10
Planting 4' × 4' apart at Rs. 1-15-3 per 100	... 28 3 6
Total	... 129 4 0

or approximately Rs. 130 per acre.

The 17th September 1904.

B. O. COVENTRY,
Deputy Conservator of Forests.

CORRESPONDENCE.

ON CERTAIN IMPORTANT FOREST QUESTIONS.

In your number for November 1903, now a year ago, you were good enough to print a note of mine on the above subject. My note has called out, as was to be expected, a good many criticisms, and, thinking that it might make the discussion complicated, seeing that most of the critics are in India and I am in England, to answer their remarks piecemeal, I have thought it best to wait for the expiry of the full year and then to ask you, Mr. Editor, to let me make some sort of reply to those who have discussed my note, most of them, I am very pleased to acknowledge, with kind personal reference to myself.

My subjects of last year were, put shortly,

1. The tendency to subordinate conservancy and improvement, especially in Burma, to the production of revenue.
2. The tendency to make people believe that knowledge of natural science, especially of botany, is unnecessary for a Forest officer.

The *first* of these was suggested by a comparison of remarks made by one former Inspector-General (Col. Pearson) in your number for August 1903 with those made by another (Sir D. Brandis) a few pages off; the *second* by a perusal of remarks made by the latter in which he contrasted the love of sport with the love of botany and entomology, saying that they were both "useful helps" to a Forest officer, but "are not forestry." You will see, Mr. Editor, that I accept the correction made in your footnote at p. 491, though the correction was hardly necessary if one went by the general sense of the whole and by previous writings and not by specific words.

The remarks and replies to my note, which I now propose to deal with, are—

- (1) Mr. Mercer's letter, at p. 566, of the number for December 1903.

- (2) Mr. R. S. Hole's letter, at p. 65, of that for February 1904.
- (3) Dr. W. Schlich's letter, at p. 116, of that for March 1904, with your own supplementary remarks.
- (4) The letters of Mr. Hauxwell and Mr. S. Carr in the number for March and May 1904, respectively.

There was also a letter on "The Use and Abuse of Forest Work in Burma" by "Burman" at p. 71 of the number for February, 1904, which I do not propose to discuss except to assure him that he is totally mistaken in supposing that my referring to Sir D. Brandis as the "old Forester" was done "slightly," for it was intended in exactly the reverse sense, as, I feel sure, most of the readers of your magazine will have understood.

Mr. Mercer's excellent letter is of much value, and shows that the recent Inspectors-General agree in the opinion which he quotes as having been Mr. Hill's, *viz.*, "that insufficient money was being laid out on permanent improvements and that the percentage of *net* to *gross* revenue had no business to be higher in India than on the continent of Europe, etc." That opinion quite reflects my own, and I was well aware that Mr. Hill and I were in accord, for we had frequently discussed the subject together, both personally and in writing. But the Inspectors-General that I had in my mind when I wrote last year were not Mr. Hill and his successors, but his predecessors, who were in office during most of my own service in the Department. My reference to "Presidencies where forest matters are not so directly governed by the Inspector-General's advice as they are in the North" was not a very well-chosen periphrasis for the 'Bengal Presidency.' I ought not to have brought in the 'Inspector-General' at all, for, after all, he is only the advisor of Government in Forest matters. Mr. Mercer shows this quite clearly in his letter, which gives a good exposition of a sound forest policy and explains how the first stage of forest finance came about, how it has now passed away, and how a second stage has now come in with a policy which we may all hope will add to the prestige and efficiency of the Department.

Mr. Hole's letter takes up the 'botany' subject. He is not quite accurate in his quotations, for I rejoice to say that I nowhere used

the words "the man *in the street* with the collecting tin" (the italics are mine), and I fail to trace in his notice in the *Indian Forester* for August, 1903, the opinion credited to Sir D. Brandis that vernacular names "have a fixity which systematic names do not yet possess." I understand that Mr. Hole has now gone to the Dehra Forest School as Instructor and I would suggest his testing, on his tours in the School Circle, the value of the vernacular names in use : he will not find such a fixity as he seems to have found in the Central Provinces. As a sort of object-lesson, let me recommend to his notice the Himalayan names for the chief conifers ; and especially a comparison between those used in Jaunsar with those of the Sutlej Valley to the west or the Ganges Valley to the east. And if he can get hold of a copy of the 'Prodromus Floraæ Peninsulae Indiae Orientalis' by Drs. Wight and Walker-Arnott (1834), let me recommend his perusal of the opinion given by these botanists, with their quotation of Dr. Wallich, at p. xxiii of their Preface. Sir D. Brandis added when he used the expression, quoted at p. xiii of the Preface to the "Forest Flora of North-West and Central India," the words 'in many instances,' and his remarks in that Preface are merely intended to show that sometimes vernacular names may be of considerable value and importance, and that scientific names also are liable to alteration, propositions which nobody is likely to desire to doubt. Of course Mr. Hole's jokes about the "pale and studious systematic botanist," the "mutilated fragments of trees," and so on, are simply 'tall talk' of which we may hope he has now become a little ashamed; at any rate I can hardly be expected to discuss them. He is on safer ground when he finally contends that Sir D. Brandis and I hold, after all, opinions which do not differ very greatly, for I have found it difficult to reconcile Sir D. Brandis' bracketing of botany and sport as useful helps to a forester, *though not forestry*, with what I used to understand were his opinions when Inspector-General. For my own part, of course, I have little to alter in or add to the opinions I expressed last year, which is that in such a country as India, where a Forest officer is liable to transfer to work in all sorts of forest growth of the most diverse character, a knowledge

of botany sufficient to enable him to use such books as there are and to recognise tree-characters, is indispensable, and, as I also remarked last year, the Forest officer who cannot use his gun on occasion, is sometimes liable to go without his dinner. But time spent by a Forest officer on botanical observation is time spent in the work of his profession, while I do not think that can fairly be said to be the case with shikar. More botanical observation is very badly wanted, for as yet we know very little about the habits and sylviculture of any but a few of the chief Indian forest trees and the study of the sylvicultural requirements and idiosyncrasies of such trees and their economic value must begin by being made precise by their accurate identification.

The next letter to be considered is Dr. Schlich's, with your remarks upon it, and all I can say is that neither you nor he can have read carefully what I wrote. I never, for a moment, proposed to myself to discuss either the *quality* or the *quantity* of the botanical teaching at Coopers Hill or Dehra Dun. The quality of the teaching is obvious to anyone who knows the attainments of the three distinguished Professors who have taught at Coopers Hill, and I have always understood that ample time was given to the subject ; but there is an old saying that you can take a horse to the water but may fail to persuade him to drink, and I had a very distinct fear that if students are led to believe, by the statements of persons of influence and authority, that one of their subjects is, though part of the curriculum, not one of much importance, they are likely to neglect it and only study it perfunctorily and just sufficiently to 'scrape through.' Of course! botany is well taught at Coopers Hill ; whether it has always been quite the sort of botany that is wanted for our purposes is another matter, but as the College is so soon to cease to exist, it is not now worth while further to discuss the subject. I might, however, make the remark that, although Professor Marshall Ward is one of the highest authorities on the fungoid diseases of trees and must have taught about them to some extent, but one of his old pupils, so far as I know, has yet attempted to pursue the subject in India, and yet it is a subject of quite as great an importance as is that of the noxious

insects. On the other hand, several of his old pupils have been doing excellent work in systematic botany (probably led to it by such considerations as those I have put forward) and have, I believe, added considerably to the knowledge of the species with which Indian foresters have to deal and which are the raw material of forest work.

And here I should like to point out what a magnificent field the more out-of-the-way forests of India still offer to those who can add something, however small, to the sum of our knowledge of Indian natural history; for nobody in India has such facilities for doing it as Forest officers have. The Forest Department has already a considerable 'roll of fame' both in botany and zoology; but India, as a whole, is as yet only imperfectly explored, and though I know that several Forest officers are at present doing a great deal, I think there must be others who can help as well when in camp, without very great interference with other duties. It is a common and very true saying that every forester is a student all his life; that to those who observe, new ideas come every day, and observation of the natural objects of the forests is surely a part, and a very important part, of the study, and may also help to relieve the tedium of many a long and often otherwise uninteresting march. My idea of what the Forest Department should be in India is perhaps Utopian, but it is at any rate a high one. Except the Geological and Botanical Surveys, which are quite small and special, it is the only Government agency in India which has to deal with natural history, and I have in my mind the Forest Department as the pioneer of scientific work, ready for the time, which must assuredly come before long, when the present purely literary system of Indian education and the selection of officers for service on purely literary grounds will come to an end.

I find I am leaving myself but little space for a consideration of the letters of Messrs. Hauxwell and S. Carr, letters which I have read with considerable interest in the expectation of finding complete answers to the propositions I put forward last year. I have certainly found a fair series of excuses, but not much of definite value in opposition to what I asserted. The first point I mentioned

was that forest management is being subordinated to the production of revenue, and I do not find that this is proved to be as fallacious as Mr. Hauxwell thinks it. Mr. Mercer more or less admitted that such used to be the case, and both Mr. Hauxwell and Mr. Carr consider that things are all right now. I can only hope they are, and that what Mr. Carr has shown to be the case in Pyinmana as to the restriction of girdlings only to forests under Working Plan or open forest that it is not intended to maintain permanently, is true for other districts also.

On the subject of selection, demarcation and settlement, Mr. Hauxwell shows (and Mr. Carr's figures are much the same) that in ten years the area of selected permanent reserves rose from 6,674 to 18,606 square miles, which is a rise from about 3·8 per cent to about 11 per cent of the area of the province. If 64 per cent is the area of 'Reserved and Unclassed' forest, it follows that no less than 53 per cent of it still remained in 1902 to be gone over, which seems to show that my contention that such work is behind-hand is not so far wrong. Doubtless there are reasons, but I wrote about what I thought to be facts and not about possibilities. And here I may perhaps suggest that nothing has as yet, that I know of, been attempted in Arracan,* although the important reports of Dr. Schlich in 1869 and Dr. Nisbet in 1882 showed that, merely from the timber point of view, to say nothing of climatic and water-supply considerations, the forests were worthy of attention. I think too that I have heard that in these matters some parts of the older Province of Lower Burma are still a good deal neglected. May I here remind Mr. Carr that I nowhere said that "the Burma Forest

* In a former article our correspondent made some very apt remarks on the subject of 'loose writing.' It is a pity that he does not apparently invariably act up to his own convictions in this respect. The following information will doubtless prove of interest :—

Since about the end of 1892 an Extra Deputy Conservator has been in charge of the Arracan forests with the following staff :—*Exec.*—2 Dep. Rangers, 2 Foresters, 6 Revenue Collectors and 8 Guards. *Cler.*—2 clerks, 2 peons, 2 dak-runners, &c.

The following staff has now been applied for :—*Exec.*—1 Dep. Conservator, 1 Asst. Conserv. or a Provincial man, 5 Rangers, 7 Dep. Rangers, 16 Foresters, 18 Revenue Collectors, 20 peons, 1 steersman, 4 rowers (for patrol boat), 20 Guards. *Cler.*—5 clerks, 12 peons, 5 dak-runners, &c. —*HON. ED.*

Officers' energies are altogether devoted to ruining the forests under their charge ; " to put such things down as my sayings was surely going a little too far !

On the question of fire-protection, I can find nothing whatever to gainsay the accuracy of what I said. The discussion on the subject of fire-protection has interested me a good deal, but the writers of various recent articles in the *Indian Forester* are, it seems to me, rather at cross-purposes. Some writers seem to be only acquainted with forests where fires are merely ground-fires among dead leaves ; and others write from experience of huge fires in long grass : let us hope, as I feel sure is the case, that the Conservators know how to adjudicate between them. Mr. Hauxwell admits that the provision of communications and buildings is behind-hand, as I knew it to be ; Mr. Carr seems to think that by "houses for the staff" I meant officers' rest-houses ; but what I meant, as Indian officers would readily understand, were houses for the Range and Beat officers who have to be supplied with suitable quarters in convenient localities if they are to be made properly responsible for their charges.

On the question of preparing beforehand for the possible flowering of bamboo, I am very glad that Mr. Hauxwell can assure us that the plan of campaign has been decided on, and I can only hope that it will not be pigeon-holed, as seems to have been the fate of my attempts to work up the 'Bhabar' grass industry in Ganjam, in regard to which he seems to have got a bit 'mixed.'

Finally, in regard to cutting teak for revenue, I do not think that I anywhere said that it was being "over cut, with a view simply of raising revenue," though I admit the soft impeachment that I certainly thought it was, not perhaps deliberately but without sufficient previous calculation ; and I believed, and do still believe, that the note of triumph which is usually sounded when a year of big surplus comes and the pat on the back which the officers who produced that surplus usually get, is very likely to tend to over-cutting. I have no means *now* of proving my belief, statistically or from personal knowledge, and I am quite willing to express my satisfaction if my forebodings prove to be wrong. The well-considered plan

which Sir D. Brandis says has been in force since 1856 was a makeshift one, as everybody knows; but it undoubtedly did good work for a time pending the introduction of Working Plans; and I am very glad to see Mr. Hauxwell's assurance that such plans will in future be prepared at the rate of 1,200 square miles annually, though even at that rate it will have taken about 15 years to finish off the area of 18,606 square miles which he gives as that of the Reserved forests of 1902.

I think that I have been able to show that Messrs. Hauxwell and Carr practically admit most of what I put forward, though they show that there are good excuses in some cases; I hope they will now admit that my writing was not so very careless after all. At any rate, I can only express myself as being quite impenitent still in that respect.

29th November, 1904.

J. S. GAMBLE.

THE TIMBER OF BARRINGTONIA RACEMOSA.

At page 363 of the last edition of the 'Manual of Indian Timbers' Mr. Gamble describes the timber of *Barringtonia racemosa* as "white, very soft and porous," and gives the weight of a cubic foot as 27 lbs., taken from a specimen collected by Kurz in the Andaman Islands; but at the same time he mentions that Skinner gives the weight as 53 lbs. per cubic foot, and the value of P. as 819, and says that the "wood is used for house and cart-building, and that it has been tried for railway sleepers."

There are therefore two opinions about the timber of this tree, one describing it as soft and worthless, the other as strong and serviceable. In order to clear up the doubt I have obtained and tested specimens of it, and I am able to confirm the statements of Messrs. Kurz and Heinig that it is soft and worthless.

To the description given by Mr. Gamble I would add that the pores are very numerous, almost filling up the whole space between the medullary rays, which are broad and clearly seen.

My specimen when first cut weighed 44 lbs. per cubic foot, but in three months it has dried down to 28 lbs. The value of P. is 302.

It is impossible to believe that this timber could ever have been used for house or cart-building, and much less could it ever have been tried for railway sleepers, nor could anyone say that it is strong and serviceable. In a word, Skinner's identification cannot have been correct, and his remarks must have referred to some other timber.

QUILON :

T. F. BOURDILLON.

30th November 1904.

FIRE PROTECTION IN THE TEAK FORESTS OF BURMA.

Under this heading your November number contains an estimate by H. S. of the damage done to standing crops of teak by forest fires, which is stated to be based on figures supplied by Mr. Rodgers. So far as I am aware, these figures only related to girdled trees, and as H. S. makes no allowance for loss of increment, for mature trees which were so damaged by fire as to be unfit for girdling, or for trees which as a result of fires have been either killed or rendered incapable of ever reaching exploitable size, the estimate appears to be somewhat incomplete. Surely 58 years of forest fires must have had some influence on the above factors, and until we have some reliable information on these points, such estimates can hardly I think be accepted as representing even approximately the actual damage by fires per square mile per annum.

G. A. F.

A DOUBLE CANE.

Some time ago Mr. Muriel brought to notice that a bamboo may have a double longitudinal cavity, and I conceive that the median wall would greatly enhance the stiffness and strength of the bamboo.

I have lately received through the kindness of my friend Mr. Watson, the Divisional Officer, a present from an old Karen headman named Ko Po, living in the Kabaung reserves, of a double cane, probably *Calamus latifolius*, Roxb., *yamata*, Burm. This cane, having apparently been split or cracked in the middle,

has grown into two parallel canes, at first half-round but presently quite circular in section.

It would be interesting in this manner to propagate the stout species of cane of half their normal thickness, thus increasing the proportion of cortical tissue and the strength and flexibility of the cane, which in this instance is used for the rafting of timber.

I have never before seen an example of this kind, and think that it must be rare. Would this 'freak' be worth sending to the Forest School Museum?

RANGOON :

23rd November 1904,

F. B. MANSON,

Conservator of Forests.

The Director, Imperial Forest School, would be very pleased to receive specimens for the Museum.—HON. ED.

PROMOTION IN BURMA AND INDIA.

I do not wish to controvert any of the facts stated by 'Taw Kwe' and Mr. S. Carr in their letters which appear in the October and November numbers of the *Indian Forester*, relating to the transfer of senior men from India to Burma ; but when they assume that the men in Burma must as a consequence have been badly treated in the matter of promotion compared with their contemporaries in India, the facts do not bear them out. Mr. S. Carr invites comparison of the position of any man in Burma of 15 years service or less with that of a contemporary in India, and is confident that the latter will have a big advantage. I will therefore proceed to make such a comparison in the case of two men who have rather more than half the 15 years service mentioned by Mr. Carr. The man in Burma we will call B, the man in India H.

B became Assistant Conservator, 1st grade, with one and a half year's service and provisional Deputy Conservator, 4th grade, with a little over 5 years service, just at the time that H became provisional Assistant Conservator, 1st grade. With about 6 years service B became permanent Deputy Conservator, 4th grade, and again at the same time H became permanent Assistant Conservator,

1st grade, a position which he still occupies, having moreover no prospect of promotion for another two years. The difference in the pay drawn by B and H is much larger than these differences in permanent promotion at first suggest, owing to the prescriptions of Article 135 of the Civil Service Regulations, which forbid an Assistant Conservator, 1st grade, to draw more than Rs. 550 a month. H has already officiated for some time in the 3rd grade of Deputy Conservators, and is likely to continue to do so, but gets no benefit at all from it, while B has for years drawn Rs. 650 at intervals. Why the 1st grade of Assistant Conservators should be selected for this hardship, particular to themselves, of not being allowed to draw more than Rs. 100 a month more than their substantive pay is a matter which might present itself to the Forest Association. It is true that a similar disability rests on officiating Conservators, but then their immediate rise of pay on officiating is Rs. 300 at least, while the mere fact of becoming a Conservator is likely to prevent a man from grumbling.

To go back to our friends B and H their case shows that however correct your correspondents may be in their facts, they are quite wrong in their deductions even though they may themselves have been unfortunate in promotion. If they consider that B has had his promotion spoiled by transfers from India, I can only say that I should like very much to be transferred to the Province where what they would consider good promotion is obtainable. To show that the superiority of promotion in Burma over some of that in India is not confined to one period, I will quote one more case. In 1896 a certain officer was transferred to Burma from the United Provinces as an Assistant Conservator, 1st grade, with over 8 years service. On the 1st July 1896 he appears in the Burma list as a Deputy Conservator, 3rd grade, a position to which he would not have attained in the United Provinces until the end of 1901. There is a second point in which Messrs. 'Taw Kwe' and Carr are under a misapprehension : they appear to think that the appearance on the list of senior men from other Provinces is peculiar to Burma. I can assure them that less than half the men senior to H have been in the province from the beginning of their service.

Lastly, it is beside the point for 'Taw Kwe' to talk as if the removal or promotion of men senior to him were of no benefit, if those men do not happen to have begun their career in Burma. If H were suddenly to find one of the men above him gone, other than those who began their service in the Province, he would get his promotion at once, but according to 'Taw Kwe' he would have no cause to be thankful. Yet the result would be exactly the same if the man removed were an original officer of the Province. It is worth remark that B has been known to grumble for the same reasons as 'Taw Kwe' and Mr. Carr. H indeed has been singularly unfortunate.

"ANOTHER NON-BURMAN."

REVIEWS AND TRANSLATIONS.

FOREST ADMINISTRATION IN THE LOWER PROVINCES OF BENGAL, 1903-04.

The area of reserved forest in Bengal has undergone an important change during the year under review owing to the final reservation and notification under section 19 of the Forest Act of four forests having an aggregate area of 45,449 acres in the Chittagong District. Two other forests in this Collectorate containing 114 square miles were demarcated, and the Conservator hopes that their reservation will shortly be completed. We believe we are correct in stating that these Chittagong Collectorate forests were notified under section 4 of the Forest Act so long ago as 1893 or 1894. It is more than probable that had not the Khas Tehsildars, who held charge of these forests under the Collector, and were therefore Forest Officers, been also appointed Forest Settlement Officers this otherwise incomprehensible delay would not have taken place. The Report goes on to state that 'so far as is known'—whatever this may mean—'outside of the Chittagong and Buxa Divisions the Provinces' contain no considerable tracts of public forest land which could be usefully reserved under the Forest Act.

The only new working plan sanctioned during the year was that of the Puri Reserves, area 110 square miles; but plans for the Singbhum and Kurseong Reserves were in the press at the close of the year, and work had been commenced on a plan for the Buxa forests and upon a rough one for the Palamau Reserves. Work on the revision of the Darjiling, Jalpaiguri, Tista and Sundarbans plans was carried on and completed during the year.

No plans exist or are under preparation for Chittagong, Sonthal Parganas or the Singalila Reserve in the Darjiling Division.

During a tour of inspection in the cold weather the Inspector-General issued detailed recommendations regarding the preparation of the Buxa and Kurseong working plans and the revision of the Jalpaiguri, Sundarbans and Darjiling plans.

Under expenditure on buildings we note that a sum of Rs. 18,000 was spent on purchasing an Old Club House at Chittagong 'for a residence for the Divisional Officer and for the accommodation of his office.' We cannot help expressing dissatisfaction, and we feel sure that many of our readers will agree with us, at this policy, which we had hoped was a thing of the past, of combining an official office with a private residence. The majority of Englishmen in a country like India do not care to have their official staff and all the hangers-on it inevitably entails daily inhabiting a portion of the house which they themselves must occupy. The case becomes even worse when ladies have to be left alone in the said building during lengthened absences in camp. We are glad to note that four substantial rest-houses were built in Puri, Darjiling and Buxa.

Under fire protection there are some interesting remarks on the subject of fire protection in forests bordering upon Native States. In several instances these latter have apparently objected to burning grass areas within their borders, although the non-firing of such has added enormously to the danger to adjacent Government reserves. We note that a satisfactory arrangement has been come to with the Nepal Durbar, and that the Bengal Government hope to have equal success with the States in Chota Nagpur and Orissa.

Under natural regeneration the sal is said to have seeded well in the Tista and Darjiling Divisions, but not elsewhere, and

there was a general flowering of the Preng bamboo (*Arundinaria hookeriana*) in the Tista and Darjiling Divisions and of a small patch of the maling bamboo (*A. racemosa*) in the latter division.

It has, we note, been finally determined that coppice reproduction of sal in the damp Duars climate is of a very feeble description, and the working plan is being revised accordingly. Successful coppice fellings of sal, *Xylia dolabriformis* and of most miscellaneous trees have resulted in the Puri Division.

Under plantations we are glad to note that the Jellapahar cantonment above Darjiling is at last to be planted up by the Department, a departure which has long been required: 97,000 transplants were put out under the working plan prescriptions in the Darjiling Division and 15,000 in the Mal block of the Tista Division.

Experiments with exotics do not appear to be a success in Bengal, but we think that perhaps the Department does not know quite enough as yet about the economic products of the forests to justify the following sweeping remark of the Conservator: "Considerable efforts made in the course of the last ten years to obtain markets for little-known economic products, and for certain well-known products which are comparatively rare in Bengal, have always resulted in failure, and the Department will do well to leave such experiments alone till it is better qualified to deal with them." Take, for instance, the sabai grass of the Singbhum Reserves. We see that the new three years' lease only fetched Rs. 1,10,000 or Rs. 16,000 less than the previous three years' term (the reason for the drop not being given). Still, even this sum is a very great advance on the Rs 1,500, which is all, we believe, that the lease fetched in the year 1893. The attempts to sell the sabai were at that period practically failures, but luckily for Bengal the Divisional Officers were not content to leave the matter alone, with the result that success was finally achieved.

Under removals by purchasers there is a decrease of 2,463,876 cubic feet under timber and 1,036,331 cubic feet under fuel respectively. The fall under timber is said to be chiefly due to the decrease in removals of sundri due to overworking under the expired

working plan. Chittagong is responsible for a decrease of 210,331 cubic feet of timber and also a decrease in the number of bamboos extracted. In these decreases we see the old excuses of deficient rains and cholera trotted out and again paraded. When we read further on "the steam launch *Helen Gray* was transferred from Chittagong, where she appears to have been of very little use," we come nearer to a more probable reason. The launch was built for Chittagong in order that inspections by the Divisional Officer might be more frequent and, shall we say, unexpected! It is true that the launch meant that heavy monthly travelling allowance bills were a thing of the past, but this was more than counterbalanced from the point of view of Government by the fact that it was possible for an Inspecting Officer in the launch to visit all the toll stations of importance south of the Karnaphuli in five days, whereas 17 to 20 days is the least probable period, without exceptional luck, under the old, now reverted to, row boat (or T. A. mileage) system. Under the new plan, which states that a sailing boat is to be tried, the above trip will take probably a month, during which the rest of the division will take care of itself, with the usual heavy drop in revenue that this has always meant in Chittagong. With the new reserves and with constant and energetic inspection of all the toll stations and revenue-making reserves the Chittagong revenue should easily double itself, but this will not be done by means of trips in a sailing boat working down south against perhaps three weeks of contrary winds.

In commenting upon the decrease in the outturn of wood the Conservator fears that it will take some years for this source to recover itself owing to overworking in the Sundarbans and to other accessible areas having been fully worked up to. 'The opening out,' he continues, 'of the more remote forests which should make good the deficiency must be gradual.' We would, we speak, without present knowledge, like to know whether the Conservator has turned his attention to the big reserves situated in the Chittagong Hill Tracts! These areas, almost, we think, from their first formation, have been closed to felling, only the removal of canes and bamboos, &c., having been permitted. Whilst we would not

advocate the throwing open of these areas to promiscuous felling, we believe that the time has come to have a careful inspection made of their contents (this will need the deputation of a special officer, since the forests are too far removed to make it possible for the Divisional Officer to carry on his ordinary duties in addition to this piece of work) with a view to the removal of the large number of over-mature trees which it is probable they contain.

NOTES ON THE COMMERCIAL TIMBERS OF NEW SOUTH WALES.*

From the pen of that admirable and indefatigable botanist, Mr. J. H. Maiden, we have before us the second edition of this small and highly useful illustrated work. In his introductory remarks the author gives the reasons for the appearance of the pamphlet. The object is to give information in regard to the principal commercial timbers of the Colony in language as devoid as possible of scientific technicalities. Only those points are touched upon that are of practical moment to the timber-getter, saw-miller, merchant, or user. "An endeavour has been made to give an impartial statement of the merits of our timbers as we know them at the present day. In course of time some of the estimates of the qualities of particular timbers may require to be modified, and other timbers, not at present employed, may be shown to be useful for special purposes." Having for many years been almost daily occupied in the diagnosis and critical examination of colonial timbers of all kinds, and having been a large user of many kinds of colonial timbers for miscellaneous purposes, and having visited most of the principal forests and saw-mills of the State, Mr. Maiden was in a particularly favourable position to undertake the compilation of such a handbook, and its usefulness cannot be overestimated.

After pointing out that timber is a necessity, the author mentions that the supply of good timbers is not unlimited (and

* Notes on the Commercial Timbers of New South Wales, by J. H. Maiden, F.L.S., Government Botanist and Director of the Botanic Gardens, Sydney. 2nd edition, illustrated. Sydney Government Printer. Price 1s.

this remark does not apply to New South Wales alone) and that cutting requires to be followed by replanting. As regards export Mr. Maiden considers that as the merits of their hardwoods become more fully recognised a largely increased demand may be reasonably expected to set in for them, and on this head he says that too great care cannot be exercised in seeing that timber which is sent to market, and particularly that intended for export, is not only good of its kind, but also belongs to a species of acknowledged merit. In the case of trees or timbers which bear a resemblance more or less strong to valuable timbers, the greatest care should be exercised. We cannot but think that the great backwardness that has dogged the footsteps of the Department in India in this respect has been due to laxity on this score, and a small pamphlet on the subject of our good commercial woods and those inferior ones which closely resemble them, with the differences clearly indicated, would be an incalculable boon to many a Forest Officer. To its absence one cannot but attribute, in part at any rate, the extreme reluctance of the great Departments, such as the Public Works, Military Works, Telegraph, to take any but the few well-known good woods, the woods which have been used from time immemorial by the native himself, without any attempt being made to find out whether there are not a number of others which would serve equally well for many of the purposes for which the more valuable timber is now used. We think that in this respect the European has followed far too blindly in the path trodden by the native of the country. Such works as "Gamble's Manual of Timbers" are far too large for useful and handy service in this respect, and until we have a really handy reference book it is probable that many of our timbers will remain unknown as far as all practical (*i.e.*, economical) purposes are concerned.

Mr. Maiden remarks upon the importance of felling timber at the proper season and on the still greater one of subjecting the cut wood to thorough seasoning processes before exportation, more especially if intended for the foreign market.

In Part II of the pamphlet the author deals with the classification and description of the commercial timbers. His divisions of

this part will explain themselves. They of course deal with the bark or wood of the various trees, leaving out of the question all systematic classificatory considerations. We have a first group termed Iron barks, then Stringy barks, (3) Pale hardwoods, (4) Red hardwoods, (5) Turpentine and Brush-box, (6) Cedar, Beech and Pine, (7) Silky Oak; She-oak, &c., (8) Black bean, Myall, and (9) Miscellaneous Brush Timbers. Under each short descriptions of the wood are given with the uses for which it is recommended, distribution and quantity available.

Part III treats of timbers for special purposes. This practically consists of a list of the principal native timbers classified according to their uses. For instance, under the heading Bee-boxes we find cedar and beech recommended ; Boat-building—cedar ; Bullock yokes—river oak, swamp oak, &c.; Carriage-building,—Red cedar, rosewood, plumwood, beech, &c.; Carving—white holly, grey myrtle, &c.; Charcoal—Murray red gum, stringy bark ; Railway keys—cedar, flindosa or cudgerie ; Railway sleepers—iron bark, grey gum, Murray red gum ; Walking sticks—(a) whole plant, tea trees, dwarf palms, native cherry, oaks, (b) cut out of solid wood, black wood, tulip, cabbage palm, &c. The value of such a useful condensed hand list cannot be overrated.

A few notes on special uses of timber, such as the wood required for backs of hair-bushes, engraving, &c., the production of such substances as naphtha, wood-spirit and tar, mining timbers, Railway sleepers, wine casks, wood pavement and wood pulp, brings this extremely useful and handy pamphlet of 38 pages to a close. At the end are nine excellent plates showing the stems of some of the chief of the large commercial trees.

We have reviewed this small work at some length because we would draw attention to the inestimable advantage such a handbook would prove to the Indian Forest Officer, and one may include the officers of the Public Works, Military Works, Telegraphs and the great timber merchants of the country. We all require a handbook for use in the forest. Neither "Gamble's Manual of Timbers" nor "Watt's Dictionary of Economic Products" can be used as such.

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

OUTBREAK OF A FATAL DISEASE AMONG WILD ANIMALS AND AGRICULTURAL CATTLE IN MYSORE.

Having seen an article entitled 'A New Disease in Coorg' in the *Indian Forester* of October last, I would wish to place upon record the following facts in connection with it which have come to my notice during the last four months :—

The disease was first noticed on a 'Kumki' elephant by name 'Kadampyari,' which was sent to Kymara, a forest station on the frontier line between Malabar and Mysore, for dragging timber in the forest ; the elephant was at Kymara for three days, but did no work, as the forester was not present. It returned to Mastigudi on the 28th May in an apparently healthy condition and dragged timber in the Kardihalla forest for two days. On the morning of 1st June a big swelling like a bubo appeared between the hind legs, which travelled on towards the neck ; the animal gave up its usual leaf fodder, but used to take in small quantities of rice, mixed with jaggery, and little or no water. The mahouts did not know what the disease was, but gave some highly stimulating medicines and also externally applied an ointment prepared of 'ragi' and a jungle root. The animal was brought to Kakankote from Mastigudi, a distance of one mile, on the first day of its illness ; for three days it was ailing from this disease, falling down and getting up repeatedly, probably owing to colic, and experienced difficulty in breathing. In spite of all the medicines and treatment afforded, the animal grew worse day by day, and succumbed to the disease on the 7th idem. Instantly a big pit was dug, the carcase was dragged to the pit by other Kumkis, burnt and buried.

About the same time a petty merchant, who had gone to Malabar, returned from Vonteangadi, a Malabar village, *via* Kymara and Sunkadkatte, with four bullocks. He lost one of his bullocks

on the road, another in his village Oyyamballi from apparently the same disease as above, and the infection spread from these into the surrounding villages around Antersante, with the result that fifty cattle died in thirteen villages in all, only seven attacked animals recovering.

I heard from the Malabar Range Officer that one of the timber-dragging elephants named 'Phyllis' was attacked in Begur, a forest station seven miles from Vonteangadi, and that all the other elephants were segregated at once ; the whole bubo was cut away and medicine applied, and it recovered. Many cattle in and around Vonteangadi had also succumbed to the disease.

These instances prove that the disease spread from Malabar into this part of the Mysore district.

To show the further progress of the disease towards Kakankote, 'Wasp,' a well-known shikari elephant, caught the infection on the 10th ; the swollen part was branded, and the animal seemed to improve, but grew worse on the 11th, and died on the 12th. The other Kumkies, *viz.*, 'Ganesh' and 'Jang Bahadur,' were segregated at once from the diseased elephant ; they had, however, caught the infection, but managed to go to Karapur, a distance of six miles. Ganesh could go no further, but Jang Bahadur, continuing its journey, reached Munchagowdanhally. The former exhibited the swelling, which increased and showed the same symptoms as those of Kadampyari, and the elephant died on the 18th in spite of all the treatment afforded. Jang Bahadur had swellings all over the body, and these began to open out after the application of an ointment. The animal recovered.

The disease now spread into the jungles, with the result that six wild elephants, five male and one female, eight bison, fourteen deer, and three sambar were found dead in different parts of the forest.

The matter was reported to Government, and the Government Bacteriologist and Veterinary officers were requested to diagnose the disease. They came to Kakankote, and had two elephants exhumed, but the process of decomposition was so far advanced that nothing could be made out of them. At Antersante the blood of Jang

Bahadur, who was recovering, was examined, and it was found to contain bacilli which the Bacteriologist thought were a variety of *Bacillus septicæmia hæmorrhagica*. He says that a similar epidemic was observed among deer and cattle in 1894 in parts of Germany, but the only new feature is the attack of elephants. The measures he recommends are the isolation of the infected animals, the prevention of the healthy ones from gaining access to the contaminated places, and the burning of the carcasses wherever practicable, or deep burial, so that the surface soil may not become infected.

CAMP METIKUPPE :

16th October 1904.

L. P. MASCARENHAS,

Forest Ranger, Kakankote.

EXTRACTS FROM OFFICIAL PAPERS.

THE TREATMENT OF HARDWICKIA BINATA.*

Copy of Letter No. 554, dated the 1st December 1903, from E. D. M. Hooper, Esq., Conservator of Forests, Central Circle, Madras Presidency, to the Conservator of Forests, Berar Circle, C. P.

I have the honour to forward the following remarks on the subject of *Hardwickia binata* :—

My first acquaintance with *Hardwickia binata* was in the Ahiri Zamindari and Godavari Taluks of the Chanda district of the Central Provinces, and subsequently I have studied it in the Godavari, Kistna, Kurnool, Bellary, Anantapur, Cudappah, Nellore and Salem districts, that is to say, in the Deccan and on the lower slopes of the Mysore plateau.

In the Ahiri Zamindari to the south of the Bhimaram reserve it was found in 1881 over a restricted area—a pure forest, the stems being strangely uniform, varying in girth from 5 to 6 feet and in height from 40 to 60 feet with clear straight bole. The soil was a quartzose red gravel, crunching under foot, and

* Communicated by E. E. Fernandez, Esq., late Conservator of Forests, Berar Circle.

I have generally observed that wherever *Hardwickia* is very prevalent, this soil occurs. Except in this locality I have seen large trees only where special protection has been constant, as at Sandur, Bellary district, in the Raja's garden; again in a forest near Kudligi and in the Bellary Civil Station. In the first case the tree with a large gnarled trunk 15 feet in girth was an object of worship; the second tree was within a temple compound wall and rose to a height of from 30 to 40 feet with a girth of 3½ feet; and the last was in a private compound about 25 feet with a clean bole, the girth at breast height being about 4 feet. I was unable to discover the age of these trees, but I imagine the tree in Bellary to be not more than 40 years old.

Elsewhere I have not found living specimens of large *Hardwickia*, even in the depths of the Nallamalai Hills of the Kurnool district, but the species is found growing to 40 feet with a diameter of 1 foot on their western base in the Cumbrun Valley on the left of this range, and in the villages there are logs of large size, attesting the existence of large trees in the past. It may also be mentioned that the cantonment bungalows built between 1845 and 1850 on the Ramandrug Hill Station in Bellary have *Hardwickia* beams. Throughout the Deccan the species is generally represented by pollarded stumps varying in girth from 2 feet to 10 feet. Where straight seedling stems are found, they are seldom taller than 20 feet with a girth of 2 feet. I imagine that this species has suffered exceptionally with the progress of civilisation and extension of cultivation during the last fifty years, for these causes have brought about, first, a demand for the wood of the mature trees, then, for the young pollard stems which yield a fibre in constant demand for rope-making and a fuel of value in iron-smelting and charcoal-making, while the leaves and young shoots are eaten by goats and horned cattle.

Next to the tamarind and nim (*Melia*) *Hardwickia* is probably the most useful tree in the Madras Deccan, and it is undoubtedly in danger of disappearing where found in the comparatively woodless areas of the Deccan, and this I consider due to the varied uses it is put to when still young; to its requiring

perhaps more protection than other species and to its gregarious habit.

As regards its distribution we find it occupying clearly defined areas on the rocky quartz soils of Bellary and Anantapur and the sandstone and shales of the Palnad in Kistna. In both localities the rainfall is small and uncertain. The young seedlings appear in profusion, and though they dry off, not only because of fires but apparently from the excessive heat of the dry season, they reassert themselves year after year until the root system is sufficiently vigorous to produce stems strong enough to withstand the heat of the atmosphere and even the passage of fires, though these latter find little to feed on in the way of herbaceous under-growth or grass in the neighbourhood of *Hardwickia* seedlings because of the hard, gritty, poor soil the species selects. From this drying down in its early life arises the shrubby habit of the young plants which is so generally observed; but after a time one stem asserts itself as in the case of *Acacia arabica* and the others disappear. Occasionally from favourable circumstances a patch of young seedlings from its earliest life grows without hindrance, and I have seen a plant grown by Colonel Doveton in prepared soil at Nagpur on the trap ridge which in one season (1880) was over 5 feet in height. The natural growth of the young tree in the dry Deccan is undoubtedly very slow, and I have watched the species in the Malpangudi and Sherbi reserves of Bellary for the past twenty 20 years and the stems have scarcely progressed.

It would appear therefore that where found naturally in this region its growth is not encouraging, and it is difficult to account for the trees which gave us the timber used in the last century except by supposing that they grew slowly in a country where little was asked of them in their youth, and in their maturity were protected from felling by the excessive hardness of the wood.

Such are the facts which I would put forward in connection with this species, and my experience certainly coincides with yours and others in showing that the species is slow to establish itself except where the soil is easily penetrable by its roots.

EXTRACT FROM BERAR ANNUAL FOREST ADMINISTRATION REPORT
FOR 1903-04.

§ 46. *Anjan (Hardwickia binata) reproduction and grazing.*—As every forester knows who has had anything to do with the anjan, it is a tree of a remarkably gregarious habit, and yet—and that is a very important *yet*—recent reproduction of it in our strictly conserved forests is conspicuous by its absence. The idea of the writer, who first began to study this tree nearly thirty-one years ago and whose views are detailed in the *Indian Forester* for November 1903, is that the existing stock is the result of unrestricted grazing and, over large areas, also of nomadic cultivation in the past. The soil which it loves is, as a rule, suited only for short periods of cultivation followed by long intervals of fallow. Since the stoppage of grazing and that primitive system of cultivation, the conditions necessary for its reproduction by seed no longer exist. In this connection the following extract from Mr. Martin's report will be read with interest :—

The anjan seeded very fairly profusely in the spring of 1902, and the seed germinated freely during the following monsoon along the Ajanta Hills, especially in the Gern-Matargaon Range around Botha and Matargaon. A very noticeable feature was the complete absence of seedlings from the midst of dense grass, that is, from areas entirely closed to grazing. They appeared wherever the grass was light and increased in numbers with decrease in density of the grass, till over areas free of grass the seedlings were quite dense.

The above was most noticeable round Matargaon. There in one and the same ravine the climatic factors are presumably everywhere identical, and the fertility of the soil can hardly vary much over localities only a mile apart (at any rate, they appear to me to be similar). In the portions of the reserve closed to grazing, and consequently covered with a dense crop of grass, anjan seedlings were completely absent, except just along road-sides, whereas in Survey Nos. 1, 2, 3 and 6 of Chinchkher, which were open to *heavy* grazing and, being situated close to a public road, were much resorted to by cattle, and as a result absolutely clean grazed, thousands of seedlings have sprung up and stand out *uninjured* and perfectly healthy. The above appears to prove conclusively that a dense growth of grass is injurious to the successful reproduction of anjan. The seedlings observed in those Survey numbers having survived, the past two hot weathers and escaped injury from cattle during the same period, when in the absence of other fodder cattle might have been expected to browse them off, grazing *throughout the year* must obviously be looked upon as a distinct advantage, in fact a real necessity.

§ 66. *Experiments for determining the best method to follow in adopting pollarding as a system of treatment for Anjan.*—In the

event of our failing to discover within a reasonable time how to effect the natural regeneration of anjan by seed, it behoves us to set about beforehand, in order to be at once prepared, with some such system as will enable us at length to begin to work our anjan forests. It is not creditable to the Department, after nearly 40 years of existence, to be able to give no better answer than a *non possumus* when asked to start the exploitation of these forests on a scientific basis. Accordingly, an area of four acres has been marked out in the Buldana Division where the necessary experiments have been set on foot. It is too early as yet to describe them.

MISCELLANEA.

THE RAVAGES OF SHIP-WORMS ON AUSTRALIAN HARDWOODS.

JARRAH *vs.* TURPENTINE.

(From "Indian Engineering.")

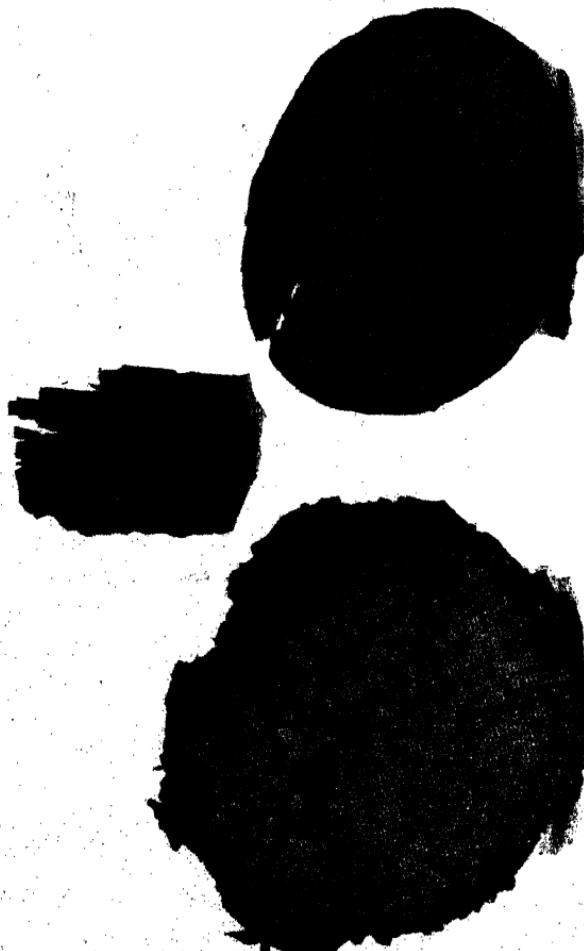
With the object of ascertaining the degree of immunity from the attacks of *Nausitoria*, commonly called *Teredo*, and other ship-worms, possessed by the well-known jarrah timber of Western Australia (*Eucalyptus marginata*), a pile of 4 feet 3 inches circumference was sent by the Government of that State to New South Wales, with a request that it should be subjected to a severe test. For the purpose of comparison it was thought desirable to test the resisting qualities of the New South Wales Turpentine (*Syncarpia laurifolia*) at the same time, so a pile 3 feet 6 inches in circumference was selected for the experiment.

In August 1897 both piles were driven, in about 10 feet of water, in the North Harbour of Port Hunter, about 2 miles from the entrance. The range of tides at this spot is about 5½ feet at springs, and 3½ feet at neap tides, the water being quite salt, except when freshes occur; it is then more or less brackish for a few days, but never fresh sufficiently long to interfere with

THE INDIAN FORESTER.

From "Indian Engineering."

No. 2.



No. 1.

The Ravages of Ship-worms on Australian Hard-woods.

No. 3.

the health of the ship-worms. The greatest tidal velocity is from 1 to $1\frac{1}{2}$ knots, and the velocity due to flood waters possibly 2 knots.

In February of this year (1904), or six and a half years after driving, the two piles were drawn, and sections cut between high and low water marks. The photograph attached shows clearly the result of the test. In the Turpentine pile the ravages of the *Nausitoria* are confined almost entirely to about an inch of the sapwood, the remainder of the pile being as sound as on the day it was driven. The jarrah, on the contrary, is completely riddled between high and low water marks, the tunnels of the worm having a longitudinal, transverse, or diagonal direction, quite irrespective of the hardness or grain of the timber.

For some reason which is, at present, not quite clear, the northern side of the pile, or the side on which the ebb tide impinges, appears to have been preferred by the *Nausitoria*.

Below low water mark both piles were practically sound, and beneath the ground-line they were in a perfect state of preservation.

It cannot of course be claimed that this one test is conclusive, for unfortunately records do not appear to have been kept of the locality in which each tree was grown, the age of the tree, the time of year in which it was cut down, or the time that elapsed between the felling of the tree and the driving of the pile. Each of these items has an important bearing upon the life of the pile, and, possibly, upon its capability of resisting the attacks of ship-worms.

It can, however, be said that the present experiment proves that the jarrah is not immune from the *Nausitoria* under all circumstances, but that the Turpentine has here added another to the long list of proofs that it is impregnable under almost all conditions to attacks of ship-worms or marine borers.

J. DAVIS, M. INST. C. E.,
Under-Secretary for Public Works,
New South Wales.

NEW WOODS.

Under this heading the *Timber Trade Journal* has a series of interesting articles of which we reproduce the first here :—

In our issue of the 24th ultimo we reported the meeting held in Liverpool under the auspices of the Chamber of Commerce of that city, and Mr. Thompson is to be congratulated on the steps he took in endeavouring to bring before the timber trade the potentialities of the resources of Southern Nigeria. It will no doubt surprise many to learn that the volume of the Liverpool mahogany trade is from four to five times greater than it was about twelve years ago. The question naturally arises to what extent can the trade continue to expand, and in what direction can that expansion be guided and stimulated ?

Thanks to the excellent service of steamers between the West Coast of Africa and Liverpool, the latter is, and must of necessity continue to be, the great clearing house for mahogany for all parts of Europe and for the States and Canada. It would, however, be superfluous on our part to explain all the causes which have brought about this result ; but, at the same time, whilst it is gratifying to learn that a freight rate of 25s. is fixed for shipments from the Niger River, we think that lower rates than 35s. (and upwards) from other ports might with advantage be adopted. If the African mahogany trade is to continue, those who face the risks of climate and the anxiety as to the results must at least see a living profit at the end of it.

It must be apparent to all that the present average of auction prices do not bring out actual expenses, and we cannot but think that there is room for competition amongst steamship owners for this class of freight, and unless the present line of steamers faces the position, there is sure to arise in the near future a smart competition for the traffic.

At the same time, we feel bound to admit that, unsatisfactory as the results to the shippers are, very much of the fault lies with themselves, in the careless and haphazard manner in which they send forward the wood, much of which is absolutely unmerchantable, and which ought not to be shipped, at least without careful manipulation.

We have previously advocated the desirability of the African merchants securing from Belize some experienced loggers ; if not, to get out the wood they might with advantage superintend its shipment, either by not allowing such grossly inferior logs to incur freight, or by judiciously cross-cutting and trimming them, so that they will not only be saleable at reasonable prices, but that in addition they will cost less in freight by reason of their reduced weight.

Another factor which the shippers overlook is that mere size in itself does not constitute value. A buyer must of necessity determine to what purpose he can apply a log, and on this he bases the price he can afford. In wood, as in everything else, the conditions of requirements vary, and in this connection there is only a strictly limited demand for large countertops, even; if really prime ; this arises from the present fashion of air-tight glass showcases, &c.

Another cause which prevents large logs commanding their otherwise intrinsic value is the small number of saw mills which can convert them, and pit sawyers are almost defunct ; now and then logs of extreme length and depth are required, regardless of cost. At present the market is altogether overdone with them, but there is an unlimitable demand for medium to moderately large sizes, say, 30 inches to 36 inches. In many cases it would be an advantage for logs 30 feet to 40 feet to be cross-cut before shipment, so as to bring them within the lower scale of freight rates.

Another depressing influence upon the value of African mahogany is that it is extremely varying in colour and texture. Possibly these remarks do not apply with any great force in the Lagos and Benin shipments, but there is room for much improvement in many of the others.

It is, of course, a moot point how far expert loggers could introduce a system of classification (and marks) of logs, according to their evenness of colour and texture, but in large constructive undertakings it is desirable to be able to secure a large quantity of logs which contain in a great degree these essential factors.

As to the various shipments of mahogany, it largely resolves itself into a question of the prices at which they can be sold; whether they will find for themselves a market. If we specifically name any, it is not with a view of injuring them ; at the same time, no possible harm can be done by our recording the fact that Gaboon wood has proved that under the present conditions it has no claim to be ranked as a furniture wood, and any shippers in sending it are courting a heavy loss ; the only good that it can do is to be a freight earner for the steamship companies. It is with considerable diffidence that we name the Sapeli shipments. Speaking off the book, we doubt to-day if they realise 40 per cent of the values current 18 to 24 months ago. In some quarters there has been a doubt as to this being mahogany any more than the so-called Australian mahogany, which latter is distinctly a variety of *Eucalyptus*.

Whatever the Sapeli wood may be botanically, it has found to-day a very low commercial value, and so long as the true mahogany is obtainable at its present current prices, shippers of Sapeli will be well advised if they only send it forward in very small quantities ; for reasons which we will pursue later it is quite possible that at some future time it may prove to be a valuable forest asset.

Coming down to the possible development of the African timber trade, the mahogany belt there comprises an enormous territory, the extent of which is as yet undetermined, against which the mahogany districts of Central America become a mere speck on the atlas—is it realised that the area of British Honduras does not exceed that of Wales?

Since the first introduction of mahogany into England no wood has been found to compare with it, notwithstanding that the world has been exploited. We well remember some 30 to 35 years ago, when the fashions in furniture changed, how for a while mahogany was discarded in favour of black walnut, the supply of which is now all but exhausted, especially where size and quality are requisite in large constructive undertakings, so that to-day it is no factor in the market. The supply of teak is extremely

limited, and its enhanced cost is making its use prohibitive. We may at this juncture point out that the European wainscot oak and quartered oak from the States are not only costly but more difficult to season and to work; the supply, especially of the latter, in good qualities is limited; hence the necessity for the Americans, with their high plane of living, the furnishing of their houses and hotels, to say nothing of the equipment of the rolling stock of their railroads, to seek foreign high-class furniture woods; at the present day not only are they practically absorbing the Central American supplies, but they are large buyers in Liverpool of mahogany from Africa, a condition of affairs which time will accentuate and tend to a greater demand than has been known in the past.

In this consideration it is impossible to ignore the fact of the high prices commanded by Canadian pine and the American canary wood, each of which enters so largely into the construction of furniture and other internal fittings.

Quebec ash has become more costly, coupled with the ever-increasing difficulty as to quality and colour, so that its meridian is passed. The so-called satin walnut can never be reckoned as a high-class furniture wood.

The consideration of these conditions, affecting as they do the cost of the article produced, and—what is also equally important—the question of the quantity available, all tend to the favourable expansion in the demand for mahogany.

Mahogany, in addition by its abundance and lowness of cost, has the following characteristics, namely, that it is not difficult to season or to work, and when wrought it will stand; as a wood for painting it is second to none; it is also capable of taking a fine polish; and last, but not the least, when manufactured, its beauty of colour and appearance at once rank it as a premier wood.

Whilst conceding all these points in favour of mahogany shippers must not imagine that it has any monopoly; we are willing to grant that they should live by their product, but as surely as the price gets beyond a certain point, so soon will

substitutes be sought and found. We have endeavoured to show that the development of the mahogany trade has not been made by an advance in prices, but rather by the cheapening of cost has its popularity grown, thereby supplanting other woods, the prices of which have advanced. So that if shippers of mahogany would maintain its supremacy; they should seek their profit, not in high prices (although really fine figured logs will always command good results), but rather to reduce their costs, either by introducing (wherever possible) mechanical methods in haulage, economy in conversion, and so to manipulate the logs that they will command their highest possible value; to ensure this it is necessary to avoid shipping "deadheads," and to cross-cut the faulty ends off many logs which would otherwise be valuable, but are simply ruined by the reckless manner in which they are spiked for snagging purposes.

Whilst it is impossible to lay down absolute rules, it is generally safe to say the spikes, if used at all, should be driven as near the end as practicable, on the hollow side, or on that opposite the snap, otherwise the best wood is frequently ruined, thereby depreciating value.

The importance of mahogany in our commercial economy justifies the length of our observations, which, by the way, apply with equal force to the handling of other furniture woods; we must, however, hold over for our next issue the consideration of how and under what circumstances strange woods may find a profitable introduction into our commercial economy.

FORESTRY AT THE WORLD'S FAIR.

The great World's Fair at St. Louis affords an opportunity to measure the real progress that forestry has made in the United States within a decade. At the Chicago Fair, in 1893, a comparatively small building served to exhibit the country's forest interests and their relation to other subjects. The building devoted to the two Departments of Forestry and Fish and Game at St. Louis covers 4½ acres, and about 4 acres more are given to outdoor exhibits and demonstrations.

But too much is said of size at St. Louis. Quality does not always keep pace with it. This, however, is probably less true of the Forestry Department than of several others.

It is an old idea that forestry and game culture go together, and therefore not unnatural to find the two combined at the Fair. There is an advantage in it in that the animals, live or mounted, serve as attractions to many people, who incidentally get some knowledge of the forestry side; yet one wishes that irrigation and the interests of the farmers could be substituted for those of the hunters. The latter are often not hunters at all but city people whose ideas of forests and forestry are chiefly of the sentimental or irresponsible kind. The hope of forestry rests more in enlisting the active interest of country people than in the enthusiasm of city dwellers. The concentration of effort that is possible in populous centres supplies a great initial force, but unless the movement reaches those who are directly concerned, there is no real result.

Inside and around the Forestry, Fish and Game building are many interesting exhibits of animals—live, stuffed, or painted. Aquaria in the Missouri, Pennsylvania, and New Jersey sections show many kinds of fishes in salt and fresh water. Yet these things must be passed over; the visitor will be sure to see what he wants of them, for in many cases they are shown side by side with what more particularly belongs to forestry.

With some exceptions, the exhibits are made by States, the national and foreign Governments or by Associations. Few individual exhibitors appear, unless it be as participators in State displays. This, of course, is regrettable, in that it limits the variety of products and processes that may be seen; it is a distinct advantage in lessening the purely commercial aspect of the show.

Some of the exhibits most worthy of note are the following:—

EXHIBITS BY FOREIGN COUNTRIES.

Germany.—In a pavilion, whose central space is occupied by a life-size bust of Emperor William in hunting costume, are shown, by means of pictures, maps, models, and tools, the technical side of forestry. The maps are copies of those used by the Forest Officers. The pictures show the character of the forests, and the labels on

them explain what the management seeks and what it has attained. A model of a broadleaf forest, with trees about 15 inches tall and ingeniously constructed of twigs and sponges, demonstrates the philosophy of thinnings. Various statistical charts also are interesting and the library of forest books. This exhibit is especially of Prussian forests, their problems and practices, and of the two Prussian Forest Schools, Eberswalde and Münden. It is the only distinctly technical exhibit made and is in every way worthy of careful study. The uniformed forester in charge speaks English and likes to answer questions.

Japan.—As in every department of the Fair, the New World Power has an extensive exhibit in the forestry building, though a large part of it is devoted to its fisheries. That the country is keenly alive to the need of looking after its forests is shown by a carefully prepared series of forest maps and a number of charts, all on German models, giving graphic information concerning the area, value, yield, etc., of the forest interests of the nation. A large number of fine specimens of commercial woods is also shown; each is carefully labelled with the scientific as well as the local names. In going over these samples one is struck with the considerable number of clear, soft, easy-working woods. If Japan were prepared to export these, she would have no difficulty in finding a market for them, but it is said that the available quantity of none is great. Perhaps the most interesting feature of the whole exhibit is a collection of bamboos—clear, straight, beautiful specimens—from the little knotty ones that are used for switch canes to poles 6 inches in diameter and 40 feet long.

France—makes only a small forestry exhibit; there are some fine specimens of cabinet woods, none of them native, and an interesting demonstration of quarter sawing on several sections of oak logs, but nothing of the French sylviculture or forest management that one would like to see. A model of a city building with pole scaffolding, such as is universally used in Europe, presents a striking contrast between their and our ways of using wood. Such a scaffolding, the pieces all lashed, not nailed, together so that it can be taken down, may serve to put up a hundred buildings. A

separate exhibit in the French section shows a fine collection of willow basket ware. It would be interesting to see more of this work, since an effort is now making to extend the industry in this country ; but, so far as I know, this exhibit is the only one at the Fair.

Great Britain—exhibits no forestry to speak of. A few photographs are interesting in showing the kind of timber that is esteemed there, and we who insist on clear, straight, white oak may learn something from the taste of the English that will profit our forests.

Canada.—The great rustic arch, which forms the chief feature of the Canadian exhibit is an attractive piece of work ; yet one wonders what it is for. The legend that it bears in letters of gold—over three thousand varieties of wood used in this rustic work all grown in Canada—is false of course, and the statement is but little bettered when it is explained that most of the pieces are from fruit tree stock, every nurseryman's variety counting one. The exhibit is really valuable in giving information relative to the Dominion's forest industries, the location and character of its timber lands, etc. These are set forth on placards and in an attractive booklet. In a separate building near by are shown some fine specimens of Canadian logs and lumber, and the only exhibit of pulp wood at the Fair. The Canadian species, of course, are the same as those found in our Northern States.

Other Foreign Countries.—Mexico, Brazil, Venezuela, Argentina, Cuba, and some other countries make exhibits of woods, and sometimes of herbarium specimens, that are interesting botanically; yet, since no one goes to a Fair to study such things, their value is not apparent. It is well known that few tropical woods are commercially important, because they are unworkable or too widely scattered ; consequently most of the specimens might as well have been left at home. One likes to see *Quebracho colorado*, the Argentina wood that is so rich in tannin, and to recognise in the really great Brazilian collection some of the more familiar cabinet woods, but it is impossible to go into details. The Portuguese exhibit of cork would be more interesting if it showed even a little

of the methods employed in handling the cork bark. As it stands it is out of place in the forestry building, being purely a manufacturer's exhibit.—A. GASKILL in *Forestry and Irrigation*.

MONORAIL TRAMWAYS IN MADRAS.—Rao Sahib T. Namburumal Chetty, the well-known contractor of Madras, has, in addition to the tramway concessions he already holds, applied to the Government of Madras, with the consent of the District Board of Chingleput, for powers to construct, maintain and use the following Ewing's monorail tramways in the District of Chingleput : From Poonamalee to St. Thomas's Mount ($7\frac{1}{2}$ miles), to connect the two lines already sanctioned by the Government of Madras ; and a line from the Municipal laterite quarries at the Red Hills along the Erukkenjeri Road to the Municipal toll-bar on that road ($7\frac{1}{2}$ miles).

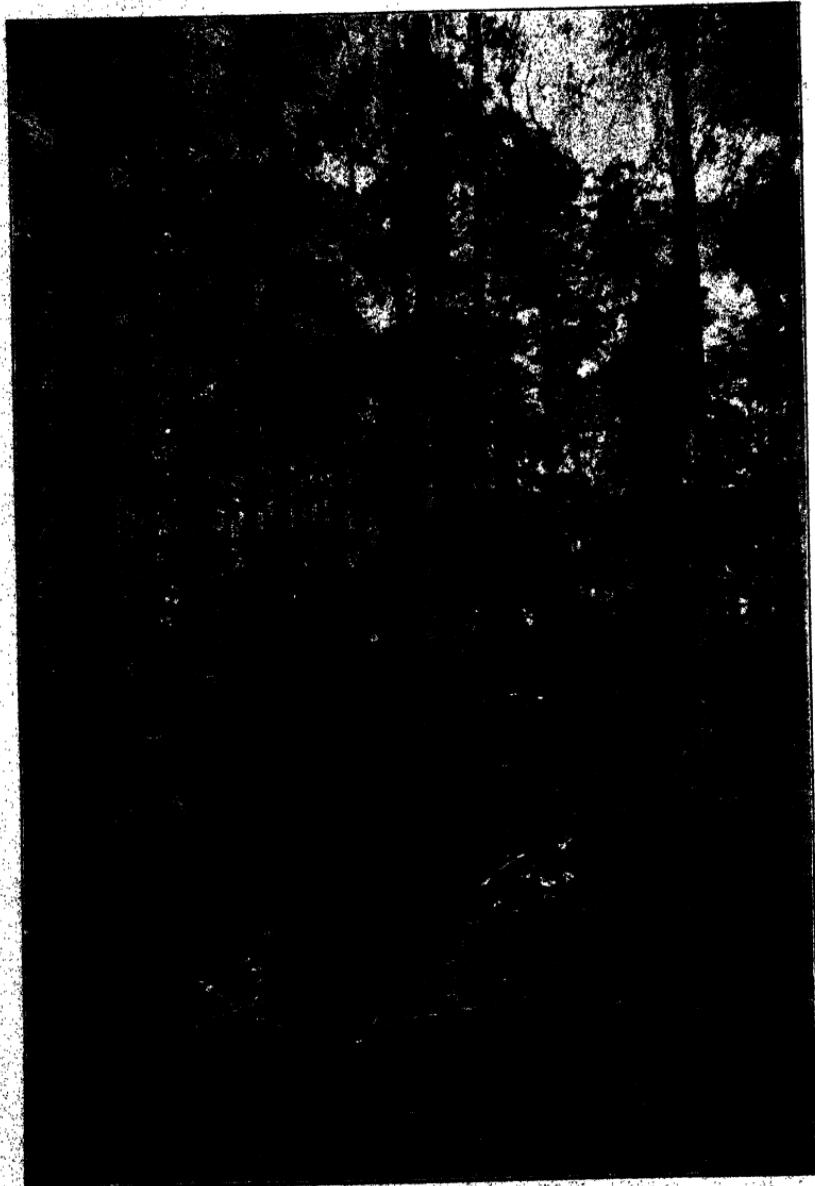
THE EFFECT OF VIOLENT WIND ON THE LEAVES OF TREES.—'Godavari' writes to us as follows: "The 15th of October 1904 witnessed a cyclone of the most terrific and disastrous nature. It began to blow a gale at 2 p. m., the wind increased in force at about 3 p. m., and blew with great violence, blasting everything before it in a most terrible manner, even snapping off the tops of cocoanut and palmyra trees with the greatest ease. The sea got up, and the danger of a bore or tidal wave, similar to the one which forty years ago submerged the whole town of Masula or Bander, was seriously apprehended. It was fortunately low tide, or the disaster would surely have followed. The writer was the occupant of a frail cockle shell of a boat, anchored not far from the mouth of one of the arms of the Godavari, keeping vigil all night in company with four timid natives, who slunk into the utmost recesses of the boat. It was a night to be remembered and one which one would scarce wish to pass through again. At length came the lull in the storm, and we were enabled to tranquilly estimate the damage done. The Casuarina plantations at B. present a deplorable state of things. Most of the larger trees have been broken off 6 to 10 feet high and the few that managed to stand have been stripped of their leaves and branches, looking like bamboo clumps on which a herd of

elephants have fed. The smaller trees, although more exposed to the direct influence of the storm, have been less unfortunate. The effect of a violent wind on the leaves of broad-leaved species of trees, with the exception of Casuarina, is most striking. They appear to have been actually scorched as by a fire. The wind, the natives tell me, was really a hot wind, in spite of a constant drizzle all night. The leaves have been virtually deprived of all their moisture by the continued violence of the wind. Will any of your readers kindly give me a scientific explanation of this scorching?

CINNAMON CULTIVATION IN ASSAM.—An interesting commercial crop reported from the Naga Hills in Assam is that of the wild cinnamon. Specimens of the bark sent to Calcutta have been valued at Rs. 7 per maund. They were somewhat thick, and it has been reported that bark of half the thickness would fetch three times as much. A Calcutta firm is said to have addressed the authorities as to exploiting the product.

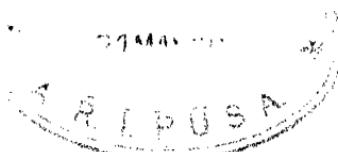
SATINWOOD SLEEPERS.—The Ceylon Forest Department took the contract to provide the Northern Railway Extension with sleepers. According to a special report the satinwood sleepers cost Rs. 8 each, while ordinary jarrah sleepers only cost Rs. 4; but the satinwood is expected to last three times as long as the ordinary jarrah.

OSPREY FARMING.—In drawing attention to an account of the way in which osprey farming might be made a lucrative and legitimate pursuit without any of the cruelties that, at present attend the production of these feathers in the market, the *Sind Gazette* says: "The question has a special interest for Sindhis. We have often drawn attention to the circumstances under which the osprey plumes are obtained in Sind. In some of the villages the unfortunate egrets are caught and blinded to keep them from escaping. If any of our enlightened Sindhis will take the matter up and start a farm on the lines suggested, they might make a very good thing out of it, and by their example they could induce the ignorant villagers to abandon their present cruel and primitive methods in favour of a procedure more in accordance with the dictates of humanity."



Photo, A. B. Jackson.

Teak Plantation about 50 years old, Nilambur.



INDIAN FORESTER

MARCH, 1905.

THE STUDY OF INDIAN NATURAL HISTORY.

OUR readers will have read with the greatest interest, perhaps in some cases not unmixed with a little indignation, Mr. Gamble's letters on "Certain Important Forest Questions." It is not our purpose here to enter into a detailed criticism of the views set forth, since they will doubtless call forth the emendation or condemnation which, according to the experience of the critic may appear to him to be their due. There is a point mentioned in the second letter, however, which we are extremely glad to see brought into prominence by a man of the recognised scientific attainments possessed by Mr. Gamble, even though we are unable to accept his deductions as being at all fair to the service which he himself has helped to shed a lustre upon.

The point in question is his allusion to the duty, for we think it cannot be justly called by any other name, which falls within the sphere of Forest Officers (we would rather say of the Forest Department) of adding to the total of our knowledge of the science of Natural History in India. In the article published last month we read—

" And here I should like to point out what a magnificent field the more out of the way forests of India still offer to those who can add something, however small, to the sum of our knowledge of Indian Natural History; for nobody in India has such facilities for doing it as Forest Officers have. The Forest Department has already a considerable roll of fame, both in botany and zoology; but India as yet is only imperfectly explored, and though I know that several Forest Officers are at present doing a great deal, I think there must be others who can help as well in camp, without

very great interference with other duties. It is a common and very true saying that every forester is a student all his life; that to those who observe new ideas come every day, and observation of the natural objects of the forests is surely a part, and a very important part, of the study, and may also help to relieve the tedium of many a long and often otherwise uninteresting march. My idea of what the Forest Department should be in India is perhaps Utopian, but it is at any rate a high one. Except the Geological and Botanical Surveys, which are quite small and special, it is the only Government agency in India which has to deal with natural history, and I have in my mind the Forest Department as the pioneer of scientific work."

We may preface our remarks by saying that we agree with Mr. Gamble in every line of the above extract, but we do not agree with the spirit in which the words were penned, nor can we believe that, were he even remotely acquainted with what the work of a divisional officer in charge of a big division is now-a-days, they would ever have been written. The paragraph is intended to point his argument that although botany was well taught at Cooper's Hill it was doubtful (to him) "whether it has always been quite the right sort of botany that is wanted for our purpose," and further "although Professor Marshall Ward is one of the highest authorities on fungoid diseases of trees and must have taught about them to some extent, but one of his old pupils, so far as I know, has yet attempted to pursue the subject in India, and yet it is a subject of quite as much importance as is that of noxious insects." Perhaps Mr. Gamble is not quite in a position to make this latter statement, but we may let that pass. We will admit that he is quite correct in both his contentions. The subject *was* taught by Professor Marshall Ward, and it *is* an extremely important one, but can he really consider that he is fair in attributing blame to the Department as a whole, and to one set of Forest Officers in particular, to wit Marshall Ward's old students, when he animadverts to the fact that these latter have not become specialists in fungoid tree diseases. Has Mr. Gamble consulted a list of Forest Officers and endeavoured to make himself acquainted

with the extent of the charges held by the majority of the Professor's old pupils, and does he realize what the administrative and professional duties of these divisions now entail? What is the daily life during the camping season some seven months in the year) such a charge necessitates? Between 4—6 hours of hard physical and mental strain in the jungle followed by several hours office work on return to the rest-house or tent, and this day after day, week in and week out, with scarce the remembrance that there is such a thing as a seventh day, the day of rest in the week. We do not write this in any grumbling spirit. The work is intensely interesting and becomes absorbing, but scant time does it allow for dabbling, even fitfully, and therefore unprofitably, in a subject which particularly requires the knowledge of the specialist; those rare exceptions where a superabundant energy happens to be combined with a very sound constitution, enabling the day's work to be extended beyond the length nature has ordained, may well be left out of consideration in the present article. But whilst we think that our criticiser's strictures are, considering the heavy charges and the present undermanned state of the Department, unfair, not to say ludicrous, we welcome the note that has been struck, since it coincides with a doctrine which we have been striving, all to inadequately, to inculcate. We do not consider Mr. Gamble's ideas on the subject of the scientific research work the Department should do and the scientific position it should hold in the least degree Utopian. We would go further and say that we hope to see the service something more than a pioneer in scientific work; we hope to see it in the foremost place amongst the well-established leaders of such work, and our hopes are all the stronger in that it is becoming daily increasingly evident that such work will prove of the greatest use economically to the Department. Work done by the scientist, or specialist as he should more properly be designated, in such a service as the forests means economic progress and research, both of which spell, as the world now-a-days is fully aware, a steady increase in the financial prosperity of commercial concerns. But this cannot be brought about under existing conditions nor by the ineffective dabblings of already

overburdened executive officers. The days when the two could be successfully combined are gone never to return.

We will turn and consider for a moment how it is that Germany, that Russia and, finally, that latest recruit, America, have done and are doing so much to bring up to date and enlarge their knowledge of the scientific natural history, or what is of more importance since the former must naturally precede the latter, the economic natural history of their several countries. We would ask has this been done by the men who are responsible for the carrying out of the executive duties which have to be put through and kept up to date? We think Mr. Gamble will agree with us that it has not. In all commercial concerns which come to the front in these days of competition, in all Government Departments in which the management and work have been brought into line with present day requirements, it is the inclusion of the specialist to assist the executive staff that has enabled this to become possible. If we glance through the Continental Services and Schools of Forestry we find the specialist at work assisting the executive officer in all questions concerning botany, zoology, chemistry; we see, as has been shown in a previous article, promising students in the Schools assisted and encouraged to go through additional courses in the subject in which they have shown a special aptitude; the idea being that the special knowledge so acquired will enable them to prove of greater use to their several Governments when they finally join the Service.

Can Mr. Gamble furnish us with the name of any of Professor Marshall Ward's students who were given such special advantages whilst at College. We could give him the names of several men who would have followed such a course gladly and would have doubtless done excellent work in India as a result of it, given the opportunities their more lucky confrères on the Continent obtain.

The allusion to the magnificent field offered by out-of-the-way forests for adding to our knowledge of natural history is doubtless intended in a botanical sense. Zoologically speaking the remark equally applies to the most accessible wooded or even unwooded areas of the country. Although almost incredible, it is a fact that

there has been scarcely a scientific Zoological expedition of any note to India as a whole since the British came to the country. Remote inaccessible spots have been visited and their fauna collected, but India has been left severely alone. The consequence is that, with the exception of a few groups, the smaller forms of zoological life are almost unknown, and amongst them those appertaining to the forests hold a very large place. Can the Forest Officer be blamed? The major portion of the little that is known is due to him, collected whilst engaged in his ordinary executive work; but this is not the way to make true progress either zoologically, botanically or chemically. To really advance the specialist is required in all these subjects.

We have alluded to the training of the recruits of the Department. We are now standing upon the threshold of a new departure, and we would suggest that, if it is found at all feasible, some of the great facilities for research work within the reach of the German, the Russian, the American, etc., forest student should be placed within that of the recruits for the controlling staff of the Indian Service. Further, that promising students should be encouraged by being allowed to spend an additional year or two on deputation at Home with a view to their going through extra courses in subjects which are known to be of the highest economic importance in India. We venture to predict that should such a course commend itself to the authorities, not only will the stigma which Mr. Gainble attaches, we think unwarrantably, to the Department be removed but our knowledge of the natural history of India, and of the Indian Forest in particular, will soon be greatly augmented, and with this augmentation will follow, as a natural result, the application of this knowledge to economic ends.

SCIENTIFIC PAPERS.

ON THE TWO SPECIES OF BLACKWOOD FOUND IN SOUTHERN INDIA.

BY T. F. BOURDILLON, F.I.S.

When Col. Beddome was writing his description of *Dalbergia latifolia* for his 'Flora Sylvatica' some thirty years ago, he made the following remarks:—

"The *Dalbergia sisoides* (Graham), common about the forests of the Coimbatore district, Palghat, the Anamallays, Madura and Tinnevelly, is a smaller tree than *D. latifolia*. The wood is generally of a redder colour, and the tree flowers in the rainy season (July), instead of the hot weather: it is always distinguished by the Palghat axemen as the Eeruputu, *D. latifolia* being called Eetee (Dr. Wight transposed these native names). I cannot however distinguish the two trees botanically; the flowers of the *sisoides* are said to be rather larger and the leaves narrower, but these differences are not constant, and the same drawing might answer for either tree; I cannot therefore look upon *sisoides* as more than a variety of *latifolia*."

This view was accepted for a long time, and all specimens of blackwood from Southern India were labelled *D. latifolia*. Later writers, however, have expressed the opinion that the two were different species, though the difficulty has always been to describe their points of difference. Thus Mr. Gamble in his 'Manual of Indian Timbers' at page 252 says: "The specimen, No. W. 3851, is probably *D. latifolia* var. *sisoides*, which seems to deserve specific rank." Again, Major Prain in his monograph on the species of *Dalbergia*, page 82, writes of *sisoides*: "This species is very nearly related to *D. latifolia*, and may indeed be only a form of that tree; the distinctions, however, seem constant so far as India is concerned, and the wood-cutters of Southern India are said to distinguish the two by their habit and their timber, and

to give them different names." Sir D. Brandis holds the same view.

Some months ago Major Prain asked me to ascertain if *D. latifolia* really occurred in Travancore, as all the specimens sent to him and labelled *latifolia* had turned out to be those of *sissoides*, and since that time I have been making enquiries in different quarters as to the existence of both species or of only one. I soon ascertained that there was a complete unanimity among all carpenters and timbermen that there were two different woods known as "eetti," and further, the samples brought to me invariably showed the same differences, and could always be distinguished. They are known as "kár-eetti" or dark black wood, and "vell-eetti," or pale black wood, and the common vernacular names for both are in Tamil "thothagatti" and in Malayalam "eetti" and "veetti."

Having satisfied Major Prain that *D. latifolia* does occur in Travancore, the next point to be determined was which of the two kinds of wood was to be referred to *latifolia* and which to *sissoides*. I was also anxious to discover if the two species could be early distinguished when growing in the forest, for Herbarium specimens are not always easy to separate.

Further enquiries and examination of trees cut for the purpose showed that the darker wood or "kar-eetti" is *D. latifolia*, and the paler or "vell-eetti" is *D. sissoides*. I also ascertained that when in young leaf the trees can be easily distinguished, even at the distance of a quarter of a mile; but when in mature leaf, they are not so distinguishable, although they can always be separated without difficulty. I will now give in detail the differences between these species.

General appearance.—*D. latifolia* attains a larger size, its foliage is more compact and always a dark blackish-green, whereas the foliage of *D. sissoides* is at first bright grass-green, and even when mature it is never so dark as the other.

Foliage.—In *D. latifolia* the number of leaflets is 3—7, generally 5, and the length of the rachis is 3-4, but rarely 5 inches. In *D. sissoides* the leaflets number 5—10, generally 7, and the rachis is 5-6 inches long. In *D. latifolia* the petiolules are very short

and slender (under $\frac{1}{4}$ inch) and the leaflets are round, obtuse or emarginate, the outermost being the largest, and the others decreasing in size inward. In *D. sissooides* the petiolules are longer (from $\frac{1}{4}$ — $\frac{1}{3}$ inch) and stouter. The leaflets are pointed at both ends and are all of the same size or nearly so. The young leaves of *D. latifolia* are very dark-green, and the mature leaves are black-green above and glaucous beneath and somewhat thin, but the young leaves of *D. sissooides* are very bright-green, and the mature leaves are a lighter-green above and paler beneath, thicker and more glabrous than those of the other species.

Inflorescence.—The flowers of *D. latifolia* are arranged in lateral panicles, axillary or from the axils of fallen leaves, and rarely terminal. Those of *D. sissooides* are terminal and are slightly larger. In other respects they are similar. Both trees flower in January-February.

Fruit.—Major Prain notes that the fruit of *D. sissooides* is narrower and at the apex less rounded than in *D. latifolia*. Further, the apex of the fruit in *D. sissooides* appears to end in a bristle which is absent from *D. latifolia* (*vide* Plates 62-63 of Vol. X of the 'Annals of the Royal Botanic Gardens,' Calcutta).

Timber.—The ground-colour of both woods is purple, but whereas that of *D. latifolia* is uniform in colour or is veined with black or red lines, and in some cases is a beautiful lake (whence no doubt the name of Rosewood) the wood of *D. sissooides* is much mixed with dark-brown and never has any tint of red in it. Some samples resemble walnut or one of the *Albizzias*.

The best way of identifying the species is to split a piece of the wood, when the red or brown tint will at once be seen mixed with the purple. Carpenters state that the wood of *D. sissooides* is harder, heavier, coarser, and does not take such a good polish as that of *D. latifolia*. My experiments with *D. sissooides* give W = 52 lbs. P = 721.

I have not experimented with *D. latifolia*, but Mr. Gamble takes as an average (quoting Sir D. Brandis) W = 50 lbs. P = 950, but says that the latter figure is too high. Probably there is not much difference in their weight and strength.



Photo, A. B. Jackson.

Two-year old Teak Plantation, Nilambur.

Both timbers sell for about the same price, but most people prefer *D. latifolia*.

Habitat.—Speaking generally, it may be said that *D. latifolia* prefers the interior forests and *D. sissooides* the outer-hill slopes; in fact they are known in some parts of the country as "Ulmalei" or blackwood of the inner-hills, and "Poromalei" or blackwood of the outer-hills. The former ascends the hills to a greater height, but I have seen *sissooides* at 2,000 feet. At the lower elevations *sissooides* predominates, but *latifolia* is also found, and from the abundance of small plants of this species it may be inferred that it was at one time more common in easily accessible parts than it is now.

Now that these trees have been separated as true species, it would be convenient to give them different English names. *D. latifolia* is generally known as "Bombay rosewood." For *D. sissooides* I would suggest the name of "Malabar blackwood."

ORIGINAL ARTICLES.

THE NILAMBUR TEAK PLANTATIONS.

By R. MCINTOSH, M.A., I.F.S.

On the west coast of Madras and lying to the north of Travancore and Cochin States is situated the district of Malabar, the home of the Naiar and the Moplah, and the scene in former days of many a struggle for supremacy between the British troops and the invaders from Mysore under Tippu and Hyder Ali. Seringapatam settled the fate of Malabar, and now all is peace except on the rare occasions when a band of Moplah fanatics "goes out," and, after a brief space of defiance, meets its inevitable fate at the hands of a few British troops.

Nilambur is a small village situated some 45 miles from the coast up the Beypore river, and lying close to the foot of the Neilgherry Mountains. The Nilambur Valley is described in the district manual as being of the shape of a horse-shoe,

surrounded on three sides by hills which rise on the north-west to 8,000 feet, while those on the north-east obtain an elevation of some 3,000 feet and lead on to the Wynaad plateau. In the semi-circle of these overhanging hills lies Nilambur, situated about 400 feet above sea level, with a rainfall which averages 120 inches and a temperature in the shade ranging between 80 and 90 degrees the whole year round. The soil of the valley is mainly an alluvial deposit, often of enormous depth and broken at intervals by patches of laterite, which sometimes take the form of small detached hills.

On one of these small hills stands the District Forest Officer's residence, whence from the verandah he can overlook the river flowing past the foot of the hill and the plantations which stretch away northwards, mainly along the banks of the river and its tributary streams. Here, alone, a Forest Officer has lived for the past sixty years, shut off from society of any sort, living a monotonous and almost primitive existence, but employed in the creation of a plantation which bids fair to be one of the most successful undertakings, both pecuniarily or otherwise, on which the Forest Department in India has ever been employed.

The sole credit of originating the plantations is due to Mr. Conolly, a Collector of Malabar. As long ago as 1840 he foresaw that the teak forests of Malabar could not long withstand the demand made on them by private rapacity and public indifference, and he suggested to Government the desirability of forming teak plantations in the Nilambur Valley.

Had Mr. Conolly searched throughout the whole of India he could not, in all probability, have hit upon a spot more suitable for his purpose than this Valley. Soil, rainfall and temperature are all that could be desired. The plantations are situated on the banks of an almost ideal floating stream, which flows into the sea at Beypore, a small port much frequented by small trading vessels from the Persian Gulf and Arabian Sea. These traders eagerly compete for the produce of the plantations, shipping it to Persia and Arabia to supply the requirements of those countries, where building timber and poles for boat masts cannot be obtained.



Photo, A. B. Jackson.

Officers' Camp Rest-house, Nilumbut.

Mr. Conolly obtained the requisite permission to start the plantations. A commencement was made at once, and there are papers on record which show that in 1844 Mr. Conolly was perplexed with the difficulty of getting teak seed to germinate and the young plants to withstand transplanting. In 1844 Chatty Menon was appointed native Conservator under Mr. Conolly, and from that date until 1862 he continued in sole charge of the plantations.

Mr. Conolly remained long in Malabar, and ultimately came to an untimely end in September 1855, when one evening, whilst sitting out in the verandah with his wife, he was attacked by three Moplahs and hacked to pieces in her presence.

Much of the land in Nilambur Valley is private property, but it fortunately happened that in 1840 one of the numerous landowning temples required ready money, and a considerable area of highly suitable land was obtained by Government on payment of a lump sum down and a royalty on every teak tree grown on the area. Subsequently Government were able to obtain further areas either on similar terms or by purchase, and the Department now possesses suitable lands amply sufficient for planting purposes.

Chatty Menon soon overcame the difficulty experienced in getting the seed to germinate, and the method adopted by him is, with a few minor modifications, retained to this day. The seed is collected in February, and sown early in April, after having been soaked for forty-eight hours in water. In sowing the seeds are covered to a depth of about $\frac{3}{4}$ inch with fine soil. On this a few small twigs are placed and on the top a layer of straw to retain the moisture. After copious watering each day the seed germinates in 15 to 20 days. The young plants are watered until the setting in of the monsoon early in June, by which time they are from 4 to 8 inches high and ready to be planted out. The planting site is felled over in the cold weather, burnt over in March, and the planting pits made ready for the planting out which is to commence in June.

From the commencement, on an average, 100 acres have been planted up each year. The work was stopped for some years

when a Conservator took a pessimistic view of the operations, but fortunately wiser opinions subsequently prevailed, and the planted area at the end of 1904 amounted to 5,378 acres.

Much credit is due to Chatta Menon for his work at Nilambur. With the exception of attempting to plant teak on the laterite areas and not realising the importance of early thinnings in his plantations he hardly made a mistake.

With the advent in 1862 of Mr. Ferguson, a Scotch gardener imported for the purpose, planting went on apace. He soon realised the vital importance of regular weedings and adequate thinnings. He prescribed four weedings in the first two years, three in the next three years, and two for the sixth year. These weedings have since been reduced to three in the first two years and two subsequently, with a weeding in the older plantations once in every five years.

Mr. Ferguson remained at Nilambur until 1883, when he was succeeded by Mr. Hadfield, who left the plantations as recently as 1894.

In 1885 a scheme was drawn up for the conduct of the thinnings, and in 1891 this was revised. In 1895 Mr. P. M. Lushington drew up the first working plan for the plantations. It covered a period of ten years, and is now in course of revision by the same officer.

Under the working plan it is proposed to treat the plantations under the system of high forest with a clean felling of the final crop followed by artificial regeneration. On first class soils the final crop should consist of forty trees per acre and on second class soils not less than fifty trees per acre. The original planting was $6\frac{1}{2}' \times 6\frac{1}{2}'$, i.e., 1,040 plants per acre. It is estimated that the age at which trees on first class soils will become exploitable, that is to say, will measure 6' 6" in girth, will be 95 years and on second class soils 140 years. The final fellings will be spread over a period of fifty years, and are estimated to yield annually 148,000 cubic feet of first class and 74,000 cubic feet of second class timber. This at the rate of Rs. 3 per cubic foot for first class and Rs. 2 for second class timber should provide a net



Photos, A. B. Jackson.

Views on the Beypore River, Nilumber.

revenue of close on six lakhs per annum during the final fellings.

That the rate of growth on the better soils is marvellous, and that the exploitable age has not been underestimated, is shown by the fact that it is by no means unusual to find among the older plantations, which are now about sixty years old, trees which exceed 120 feet in height and 7 feet in girth.

It is difficult to realise that in these plantations the Madras Government possesses a property which will, unless something very untoward happens, in about 35 years from now commence to yield a net profit of some six lakhs per annum, irrespective of the revenue which will be derived from the thinnings going on in the younger plantations concurrently with the removal of the final crop.

These thinnings are in themselves of considerable importance. They yield a very large revenue, and until the time comes for the removal of the final fellings they are of primary importance. It is hoped that the revenue from the thinnings will very considerably more than cover the entire expenditure on the plantations, leaving the final crop as clear profit. Nor can it be said that this is too sanguine a view to take. The results from the commencement up to date much more than justify this estimate. From 1840 to 1904 the total receipts from the plantations have amounted to Rs. 17,41,739, while the total expenditure, including land purchase amounts, establishment and every other charge which could possibly be set against the plantations, only amounts to Rs. 15,32,308. In other words, the plantations so far have not only paid for themselves but have in addition provided a bonus of over two lakhs.

In arriving at the above result the question of interest has been left out of account, and consequently the figures do not show the true state of affairs.

If compound interest at 4 per cent is allowed, then the expenditure up to date amounts to Rs. 37,14,091 and the revenue to Rs. 35,31,013—that is to say, the Forest Department at the present moment is less than two lakhs out of pocket over

the plantations, and as a set-off against this cash deficit has, in addition to the ownership of the land which has been acquired for the plantations, an area of over 5,300 acres stocked with teak from 60 to 1 year old, the value of which at the present moment must be, although it is not easy to estimate it, something very large indeed.

THE FORESTRY EXHIBIT AT THE BOMBAY INDUSTRIAL AND AGRICULTURAL EXHIBITION.

An Industrial and Agricultural Exhibition was held in Madras last year simultaneously with the meeting of the National Congress there, and this year a similar exhibition has been held in Bombay, but on a much larger scale. A not unimportant part of the collections was the Forestry Exhibit, and we propose to give here a brief description of its more important features.

The Forestry Section was divided into three groups : (a) Economic Products ; (b) Timbers ; (c) Miscellaneous. These groups were shown in sheds with sloping roofs made of bamboo framework, covered with canvas and lined inside with white cotton sheeting. The western and northern portions of the sheds were enclosed by walls lined also with white cotton sheeting. These walls, which were about 8' 4" high, extended almost up to the roof, leaving a space of about 1½' for ventilation. The Economic group was 69' × 33' and the other two were 37' and 33' × 30' respectively.

In the centre of the Economic group was a wooden structure 3' × 12' surrounded by a rope-railing consisting of tiers of shelves rising on either side and culminating in a top ledge 3' broad. Arranged on the tiers of this structure, were economic products of all descriptions, consisting of roots, tubers, leaves, fruits, seeds, barks, fibres, gums, resins, oils, honey, rubbers, lac (in all its stages), specimens of water-yielding plants, articles of bamboo manufacture, native musical instruments, made of various woods, etc. It would occupy too much space to describe in detail the various exhibits under the above heads, but it may be of interest to touch upon a few of the more prominent ones.

Roots and Tubers.—Among these the roots of *Pogostemon plectranthoides* and *Plumbago zeylanica* are the most interesting. The juice of the former is utilised in snake bite and is alleged to be a specific in such cases as is the latter in plague. The juice of the roots is apparently rubbed on the swellings which occur in plague and effectively burns them out. The wild yams are represented by large specimens of *Dioscorea bulbifera*, *D. pentaphylla*, *D. daemona* and others, and by interesting specimens of the tuberous root stock and sheathing leaf stocks of the wild plantain (*Musa superba*), which are of considerable economic value according to a paper read by Mr. Ryan recently before the Bombay Natural History Society, and published in the Society's 'Journal,' Vol. XV, page 586.

Rubbers.—Good specimens of *Ficus elastica* and *Hevea brasiliensis* have been supplied by Lieut.-Col. Wyllie, Cantonment Magistrate of Belgaum, well known as the originator of certain large rubber plantations in Burma. Professor Gammie, of the College of Science, Poona, also supplied a specimen of rubber obtained from *Oryctostezia glandiflora*, a climber which is said to be spreading about gardens in the Konkan. Professor Gammie, it may be mentioned here, also supplied some excellent herbarium specimens of well-known forest trees for exhibition as well as photographs of the same.

Water-yielding Plants.—These included wood specimens of and liquid from *Calycopteris floribunda*, *Vitis adnata* and *Ficus glomerata*, and liquid from the gram plant (*Cicer arietinum*) and Sugarcane (*Saccharum officinarum*), and Cocoanut (*Cocos nucifera*).

Copy of a paper recently read before the Bombay Natural History Society on the water-yielding properties of *Calycopteris floribunda* accompanies the wood specimens of the plant on exhibit, together with a large photograph of the climber as seen in the Thana Forests. It appears that a sample of the liquid from the stems of this plant was analysed by the Bombay Municipal Analyst, through the courtesy of Mr. Hervey, C. I. E., Municipal Commissioner, Bombay, and that it was declared fit for drinking purposes. In addition to its utility as a water-yielding plant it is

of considerable economic value as a spirit; also in providing material for what is known as tahal for rab in the Konkan. The climber is difficult to eradicate, for, in addition to its coppicing well, it also reproduces itself by root-suckers and by means of its stoloniferous branches.

Ficus glomerata yields a reddish fluid from the roots by incisions made in them, and as much as a quart can be obtained in a night. This is used medicinally as a cooling draught after measles and small-pox especially.

In the case of the gram and sugarcane the liquid is gathered from the leaves, and the note accompanying the former is as follows: "A piece of cloth is tied to a long pole in the form of a flag, and this in the early morning is swept over the field of gram, whose leaves are all bedecked with dew. The moisture thus captured is wrung out and bottled, and is used in diarrhoea, in cholera, and also in other stomach complaints.

Lac.—The exhibits under this head are especially of interest to the merchant, for they include the insect, branches covered with the lac incrustation from Sind and Guzerat, stick lac and shellac, and lacquerware from Sind. Large quantities of lac are obtainable in Sind, chiefly on the Babul (*Acacia arabica*) and also on Khandi (*Prosopis spicigera*), and in Guzerat on Butca *frondosa*, and other jungle wood trees.

Seeds.—The uses to which various forest seeds are applied are demonstrated in an interesting exhibition of chicks and other articles such as necklaces, curtain loops, flower vases, etc., made of seeds by the Sisters of the All Saints Home, Mazagon. Job's tears (*Coix lachryma*) are very prominent in the collection, and there is a very handsome door chick, exhibited with the permission of Mrs. H. S. Lawrence, made of *Coix gigantea* seeds and alluded to by Sir George Watt in his Note on *Coix*, recently published by the Government of India.

It may be mentioned in passing that the All Saints Sisters would be very grateful if seeds of a hard texture such as *Elaeocarpus Ganitrus* and *Cæsalpinia Bonducilla*, *Mimusops Elengi*, *Adenanthera pavonia*, etc., were supplied to them for the purposes of

their industry at Mazagon, and they will be happy to pay for any seeds sent, provided of course the cost of collection, etc., is not too heavy. At present they purchase *Elaeocarpus Ganitrus* seeds in the Bombay bazar at about 4 annas per 100. Seeds of that giant climber *Entada scandens* are largely utilised by them, and will be thankfully received. This is one of those plants the seeds of which might be collected for ornamental purposes without any misgivings, for the plant is of no value except to the wild tribesman in the Konkan, who uses the bark for cordage.

The seed collection forms a very interesting feature of the Forestry Exhibit, and has attracted large numbers of visitors.

Fibres.—About thirty different fibres are exhibited, and noticeable among them is the Sisal fibre from *Agave rigida* together with specimens of the handsome matting made from it, and three very handsome specimens of the plant, one in the poling stage. The Rev. W. Winsor of Sirur in Poona, who is responsible for this exhibit, also shows an interesting new machine for extracting the fibre from the leaves, a patent for which has been applied for. This machine is likely to be in much demand judging by enquiries. There is little prospect, however, at present, of Sisal fibre matting competing with Coir, for the price of the former ranges from Re. 1 to Rs. 1-4 per foot against annas 6 for the latter.

Timbers.—All the best timbers exhibited are mainly from the Kanara Forests, and they include teak, black wood, *Albizia lebbek*, *Calophyllum tomentosum*, *Artocarpus hirsuta*, *Artocarpus Lakoocha*, *Alseodaphne semecarpifolia*, *Chickrassia tabularis*, *Shorea talura*, *Mimusops Elengi*, *Dysoxylum glandulosum*, *Calophyllum Inophyllum*, *Terminalia tomentosa*, *Phyllanthus emblica*, *Stephogyne parviflora*, *Eugenia jambolana*, *Gmelina arborea*, *Cassia fistula*, *Adina cordifolia*, *Albizia odoratissima*, *Bauhinia racemosa*, *Schleichera trijuga*, *Albizia procera*, *Stereospermum xylocarpum*, *Pterocarpus marsupium*, *Anogeissus latifolia*, *Hopea Wightiana*, *Artocarpus integrifolia*, *Terminalia paniculata*.

A good specimen of Anjan (*Hardwickia binata*) was sent from Khandesh and of *Populus euphratica* from Sind. But the

above does not exhaust the list of species exhibited. Most of the specimens are displayed in rectangular pieces, 4 feet long and from 1 foot to 2 to 4 feet wide by 1", half being polished by Messrs. Alexander Mackenzie & Son of Bombay. Through the courtesy of the latter two very handsome pieces of Teak also are exhibited, one being a specimen of Figured Teak from the Haliyal Depôt, Kanara.

The rectangular pieces of timber bear detailed descriptions of the uses to which they are adaptable, and they are all arranged so as to facilitate inspection.

Timber in the log and blocks for street paving 9" x 5" x 3", of the size used in London, were also exhibited. A note attached to the latter shows that the qualities needed for such blocks are that they should be hard but not brittle.

An interesting exhibit, priced at Rs. 250, is a collection of small blocks of timbers, representing volumes in a book shelf, bearing their scientific as well as native names. This exhibit won a prize at the Madras Exhibition last year. It was prepared by Mr. A. V. Coelho, Timber Contractor, in Kanara.

A trophy (of 31 different timbers, all from the Konkan), designed by Mr. Murzband, C.I.E., Executive Engineer (retired), stands in the form of a pyramid in the quadrangle behind the Economic and Timber Courts. Two bamboos from the Bansda State, in Guzerat, one 75 feet high, are erected close to the trophy.

Miscellaneous.—Under this head the process of charcoal manufacture, which forms an important industry in the Presidency and Sind (about 50,000 tons being manufactured annually), and an interesting hay press, erected for the first time and designed by a Parsee, Mr. Irani, Range Forest Officer, are exhibited. From the note appended to the hay press it is gathered that during the last famine (1899-1900) the Bombay Forest Department collected and pressed over 18,000 tons of grass by means of hand-presses and despatched the same to the famine-stricken areas, and that hay-pressing operations with Mr. Irani's new press are now about to be carried on in Khandesh to meet the demand for fodder in Guzerat.

Mr. Irani is to be congratulated on having invented a very useful machine, the patent for which has now been applied for.

Photographs.—Most of these, representing forest problems and operations, are the work of Messrs. Limaye and Budbudé, Rangers in the Thana District, and some have been provided by Mr. R. S. Pearson, I.F.S. An excellent series of photographs of Palms introduced into and indigenous in Bombay are exhibited by Mr. H. M. Phipson, chief of the energetic Secretaries of the Bombay Natural History Society. Three interesting photographs by Mr. E. R. Stephens, I.F.S., showing the Dehra Dun Forest School Building and Students' Quarters, kindly sent by the Director of the School, are also exhibited.

Maps, Working Plans and Forest Literature.—A map, on a scale of 48" to 1 mile, showing the distribution of Forest lands in the Bombay Presidency, supplied under the authority of the Inspector-General of Forests and through the courtesy of the Superintendent of Forest Surveys, is on exhibition, as also a map of one Working Circle of the Forests of the Wada Range, Central Thana Division. A brief popular description in large type of the method of exploitation of the Thana Forests, which are adjacent to Bombay, accompanies this map, and below on a table are arranged printed copies of all the sanctioned Working Plans in the Presidency and Sind for the benefit of those who may wish to know more about the management of the Forests in other parts of the Presidency.

The standard works on the Forest flora of the country are also exhibited.

Two Native States, Bansda and Baroda, have included their exhibits in the Forestry Courts.

To add to the interest of the Exhibition a few representative wild tribesmen from the Konkan were brought in, and the methods by which they trap and snare birds and animals are demonstrated by themselves. This naturally has formed a very popular feature of the Exhibition. Through the courtesy of Col. Bannerman, of the Parel Research Laboratory, the various poisonous snakes of India are also exhibited alive in glass cases, and three times a week

practical demonstrations are given in extracting the venom from the snakes and on feeding them. It appears that antivenene as at present prepared at Kasauli is useless for the venom of any but the Cobra and Naia Tripudians.

The following are the snakes exhibited : Cobra, Naia Tripudians, common Krait, Bungarus Cœrulens, Fursa, Russell's Viper, and the green pet viper, Lachesis anamallensis, one of the representatives of the Rattlesnake in India.

Through Mr. Mahalaxmiwala, Superintendent of the Victoria Gardens, Bombay, about fifty living specimens of plants, mainly of economic value representing Rubbers and Fibres, adorn the Economic section, and there may be also seen here a specimen of the teak and camphor trees. A specimen of the quinine plant, the only one probably in the Presidency, was also exhibited.

Bearing in view the short time granted in preparing for the Exhibition, *viz.*, about two months, and the sum allotted for expenses of the Forest Section, Rs. 2,000, the latter may be said to have been eminently successful.

Mr. G. M. Ryan, F.L.S., Deputy Conservator, Bombay Presidency, was the organiser of this Forestry Exhibit, and he is to be congratulated on the success which has attended his efforts.

CORRESPONDENCE.

FIRE PROTECTION IN THE TEAK FORESTS OF BURMA.

I.

A number of letters have lately appeared upon this subject in the pages of the *Indian Forester*. So far, however, no attempt seems to have been made to enumerate the teak seedlings and young poles in two adjoining pieces of forest of similar description, one of which has been successfully protected for many years and the other annually burnt from time immemorial. It is the purpose of this article to record the results of an enumeration of

teak seedlings and young poles in two adjoining areas of moist mixed forest of precisely similar nature, one of which has been fire-protected since 1872-73 and the other burnt annually. This enumeration was carried out by the writer during January 1905, the two pieces of forest enumerated being (1) the north-western portion of Compartment 4 of Kadinbilin Working Circle, Tharrawaddy Division, and (2) the unclassed forest lying immediately outside the external fire-line of Compartment 4 of Kadinbilin Working Circle. These two areas will be referred to below as Plot A and Plot B, respectively. A brief description of each plot will serve to explain the figures recorded below:—

(1) *Plot A.*—Area 37 acres. In the north-western corner of Compartment 4, Kadinbilin. Moist, upper mixed forest in hilly country, the slopes varying from gentle to moderately steep. The forest is rich in teak, which is far more plentiful than any other species. Bamboos cover the ground throughout, the species being *Kyathaungwa* (*Bambusa polymorpha*) and *Tinwa* (*Cephalostachyum pergracile*). The bamboos are heavily cut every year by bamboo-cutters, while bamboo dragging paths traverse the area in several places; this renders the bamboo canopy much more open than is usually the case in fire-protected forest, large gaps being frequent. Fire protection was started in 1872-73. There are no detailed records as to the success of fire conservancy until the year 1888, but we know from the annual fire maps that since 1888 this Compartment has never been burnt. Works of improvement appear to have been carried out between 1875 and 1880; these consisted of girdling inferior species, teak seed being dibbled in over part of the area. Improvement fellings were carried out in 1898-99, but no seed was dibbled in.

(2) *Plot B.*—Area 24 acres. Within a stone's throw of Plot A, but outside the fire trace, in unclassed forest which is burnt annually. As in the case of Plot A, the forest is moist upper mixed forest, the slopes varying from gentle to moderately steep. The proportion of teak over two feet in girth is perhaps equal to, and is certainly not greater than, that of Plot A. The bamboos are similar to those of Plot A, and are felled annually for

extraction. Owing to annual burning, however, the undergrowth of small-sized bamboos, characteristic of fire-protected forest, is almost entirely absent. In every respect the two Plots must have been practically identical before fire-protection was started. It should be stated that the difference in the areas of the two Plots is accidental. It was thought at the time when the plots were marked out that the areas would be approximately equal, and it was only on computing them afterwards that they were found to differ so much.

The enumerations.—The object of the enumerations being to ascertain the effect of continued fire-protection on the natural reproduction of teak, only teak trees below two feet in girth were enumerated, as only these could have been affected by fire-protection during the past 30 years. As a matter of fact it was found by felling a few poles in Plot A that in this Plot it takes a teak tree about 20 years (excluding the time taken to establish itself) to reach a girth of one foot. The trees enumerated in each Plot were divided into three classes, two of which were again divided into two sub-classes each, as follows :—

CLASS I.— <i>Poles 1 foot to 2 feet</i>	}	(a) Sound.
<i>in girth.</i>		(b) Unsound and dead.

CLASS II.— <i>Poles and saplings</i>	}	(a) Sound.
<i>under 1 foot in girth, i.e., saplings which in unprotected forest would be well out of reach of all ordinary fires.</i>			(b) Unsound and dead.

CLASS III.—*Seedlings* (so-called), *i. e.*, young teak plants which in unprotected forest are not out of danger from fire.

The vast majority of these are in reality not seedlings but new shoots from saplings killed by fire or suppression. For the sake of convenience all these will be referred to below as seedlings.

The following is a tabular record of the actual enumerations carried out in the two plots :—

CLASS.	Number of poles, saplings and seedling in each plot.		Corresponding num- ber of poles, saplings and seedlings in 50 acres.	
	Plot A, 37 acres, fire- protected.	Plot B, 24 acres, unprotec- ted.	Plot A, fire-pro- tected.	Plot B, unprotec- ted.
I. Poles 1 foot to 2 feet in girth.				
{ (a) Sound ..	129	65	174	135
{ (b) Unsound and dead ..	81	14	109	29
II. Poles and saplings under 1 foot in girth.				
{ (a) Sound ..	18	68	24	141
{ (b) Unsound and dead ..	90	18	121	37
III. Seedlings ..	16	296	62	616

A few remarks on the condition of the plants in each class will be necessary to more fully explain these figures.

Class I, poles 1 foot to 2 feet in girth. In Plot A (fire-protected forest), nearly half of the 129 sound poles are still in danger of suppression by bamboos, and were it not for the extensive bamboo cutting annually the number of sound poles would undoubtedly be much smaller. In the same plot, of the 81 unsound and dead poles, some 75 per cent have been killed outright by suppression, while the remainder have been so suppressed by the bamboos that there is no hope of their ever recovering. In Plot B (annually burnt) the 65 sound poles bear no signs of damage from fire; they are vigorous and have little to fear from future suppression, the annual burning of the bamboos keeping the clumps well apart. Of the 14 unsound and dead trees in the same plot about half are dead, and in every case they appear to have been killed by suppression and not by fire.

Class II, poles and saplings under 1 foot in girth. In Plot A (fire-protected forest) the 18 sound poles are struggling against the bamboos, and only a very small proportion of them can hope to make their way through. Of the 90 unsound

poles about 80 per cent have been killed outright by suppression, and a very few of the remainder will possibly be able to get through the bamboos. In Plot B (annually burnt) a good proportion of the 68 sound poles have every prospect of making their way through the bamboos, owing to the open growth of the latter in consequence of the annual burning. The damage done to the teak poles by fire is almost insignificant; such of the 18 unsound poles as have been killed outright bear every sign of having been killed by suppression and not by fire. On the whole the vigorous appearance of the poles and saplings between 1 foot and 2 feet in girth in the annually burnt plot forms a strong contrast to the unhealthy appearance of the poles and saplings of the same dimensions in the protected area.

Class III, seedlings (so-called). Of the 46 seedlings enumerated in the fire-protected plot some 75 per cent were found on examination to be shoots from the base of saplings killed by suppression; from the weakly appearance of these shoots it appears doubtful if any of them will survive. Of the remaining 25 per cent all but two were found on broad dragging paths and in openings caused by extensive bamboo felling; these latter two were found in more or less dense shade, but they were so weakly that they will probably die off before long. Of the 296 so-called seedlings in the annually burnt area the vast majority are annual shoots from rootstocks, the shoots of which are burnt back each year. These shoots frequently escape damage for one, two, or three seasons in succession, and thus every year a proportion of them get beyond the reach of fire. This fact at once strikes the eye of anyone passing through an annually burnt mixed forest containing teak, and it is fully supported by the figures given above in the tabular record of enumerations, otherwise there is no means of accounting for the large proportion of sound saplings and poles which have got beyond the reach of fire in the annually burnt area.

It is impossible by mere figures, however accurate, or by verbal descriptions, however vivid, to give any idea of the terrible destruction which is being wrought in our once valuable moist mixed forests by prolonged fire-protection. In the present instance

we have a typical piece of moist mixed forest rich in teak produced in the days when the area was annually burnt; we find the large trees, the medium-sized trees, and the small trees in their proper proportions, but there it ends. The vigorous poles, saplings and seedlings which we find in profusion in an area identically the same, but which has been annually burnt over, are in the protected area conspicuous by their absence, and in their place we find masses of dry sticks representing the formerly vigorous teak poles and saplings which have been killed by the suppression of the favoured bamboos and soft wooded species. There is only one conclusion to be drawn, and that is that we are most certainly exterminating our teak by fire-protection. The moist upper mixed type of forest with *kyathaungwa* and *tinwa* bamboos is by far the most important type with which we have to deal in the Pegu Yoma Forests, as it produces the best class of timber. The plots chosen for enumeration on the present occasion are exactly typical of many hundreds of square miles of moist mixed forest in the Pegu Yomas, and what holds good for these plots will hold good for the great mass of forest. If anything the protected plot enumerated on this occasion gives a more favourable view of the results of fire-protection than it should do, for not only have works of improvement been carried out on two occasions during the past 30 years (a most unusual thing) but such extensive bamboo felling as is carried out annually in this area is quite unknown in the vast majority of our forests, and is accountable for nearly all the seedlings and saplings which do exist.

It must be difficult for anyone who is acquainted with the beneficial results of fire-protection in other parts of India to grasp the fact that it is exterminating the teak in the moist mixed forests of Burma. The writer himself has seen something of the wonderful results of fire-protection in Northern India, and would be the last person to condemn it in any case where the results were beneficial. In a Himalayan forest of *Pinus longifolia* for example, the effect of fire-protection is to produce a mass of natural regeneration which could not possibly be obtained if the forest were burnt annually. In a Burma moist mixed forest the result as

far as teak goes is precisely the opposite. Prolonged fire-protection kills out the young teak, and in time we shall be left with nothing but mature trees in our fire-protected forests ; when these are removed we shall have no teak at all. In an annually burnt mixed forest containing teak, in which gaps have been formed by the felling of trees of other species, we frequently find masses of vigorous young teak saplings and poles, the majority undamaged by fire owing to the power of teak to resist damage by that element ; such a spectacle, which the writer has never observed in a fire-protected forest, at once calls to mind the masses of vigorous young *Pinus longifolia* plants in a fire-protected forest of that species. The burning accomplishes in the one case what the fire-protection does in the other.

The state of affairs revealed by the enumerations in the present instance can perhaps be most forcibly represented by the aid of a couple of diagrams, based on the figures in the tabular record of enumerations given above. We may neglect all dead and unsound poles and saplings as having no future. We may also neglect trees above two feet in girth, as these trees may be assumed to have established themselves before the days of fire-protection : confining ourselves therefore to seedlings (so-called) and to sound poles and saplings under two feet in girth we obtain a graphic representation of the enumerations in the following two diagrams :—



DIAGRAM I.—Representation of sound young teak in 50 acres of moist mixed forest which has been fire protected for 30 years. Each stroke represents 10 plants.

A = Seedlings, 62 (including shoots from the bases of dead saplings).

B = Saplings under 1 foot in girth, 24.

C = Poles and saplings 1 foot to 2 feet in girth, 174.

Note.—Nearly all of A and B, and a good proportion of C, are in danger of being killed by suppression.



DIAGRAM II.—*Representation of sound young teak in 50 acres of moist mixed forest which has always been burnt annually. Each stroke represents 10 plants.*—

A = Seedlings, 616 (including shoots from the bases of dead saplings) not yet out of danger from fire.

B = Saplings under 1 foot in girth, out of danger from fire, 141.

C = Poles and saplings 1 foot to 2 feet in girth, 135.

Note.—The great majority of B and C have little to fear from suppression, and may be expected to develop in the ordinary course of events.

This article is not intended to be a tirade against fire-protection in general, but it does claim to reveal the correct state of affairs in natural moist upper mixed forest containing teak, such as is found in the Tharrawaddy Division. Figures and records of observations in other types of forests are still wanting, and it would be interesting to find out under what conditions fire-protection ceases to be injurious to teak forests and commences to become beneficial. There must be in other parts of Burma many old fire-protected areas, with adjoining unprotected areas of the same type,

in which comparative enumerations could be carried out. The matter is of such vital importance that it is to be hoped that Forest Officers will endeavour to find time to carry out a few such enumerations and favour the readers of the *Indian Forester* with the results.

THARRAWADDY, BURMA:

1st February 1905.

R. S. TROUP,

Deputy Conservator of Forests.

II.

So much has already been written about fire protection in Burma that one hesitates to further trespass on your space; but with your permission I would like to sound one note of warning.

But a few years ago there was a cry for general protection; every Reserve was to be fire-traced at the earliest possible moment, and all other work was to be sacrificed to this end.

There seemed to be a general consensus of opinion that unless a Reserve was protected it was doomed to destruction, and that successful protection only was required to obtain the best possible results from the teak forests in our charge. There were some to whom this line of thought did not commend itself, and the discussion that then ensued led to the more careful study of the question. Since then the opinions of many have undergone a change, and there are probably few Forest Officers in Burma who now regard fire protection as a general panacea, or who would advocate its general and indiscriminate extension. Many would go further and say that all fire protection is unnecessary and even harmful. It is to these that I would address these lines. The pendulum has swung upwards, stopped and is now descending; let us not allow it to swing too far in the opposite direction.

The great objection urged against fire protection is its effect on natural regeneration and, from the many letters that have appeared in your journal, there is very strong presumption that

it is actually harmful in this respect. Let us assume that this is the case ; is it not going a little too far to therefore brand *all* fire protection as a mistake ? Is natural regeneration the only question that the Forester is called upon to study ? Cannot every Forester in Burma point to thousands of acres of teak forest where there is ample regeneration, areas where the seedlings come up in thousands every year only to be burnt back by the annual fires ? Can any practical man urge that in such areas a few years successful protection, to allow these seedlings to attain such dimensions as to place them beyond the effects of fire, will be harmful ? I would urge *moderation*. The solution of the difficulty probably lies in adopting a course midway between the general protectionist and the anti-protectionist. Fire to some is our most useful assistant, to others our most dangerous enemy. From certain points of view both may be right and both may be wrong. Instead of discussing who is right and who is wrong let us rather study how best to control and use fire so as to rob it of much of its harmful power and utilise whatever power for good it may possesss.

H. S.

THE DEVELOPMENT OF THE SAL FORESTS IN THE DEHRA DUN.

In the November 1902 number of the *Indian Forester* Mr. Milward wrote a reply to my previous note (published in September 1902) on the above subject, and I should like to make the following remarks with reference to his letter.

At the present day in the Dehra Dun on the plains there are two topographies which must be clearly distinguished, namely, the high ground, which is well above the river beds, which we may call the old alluvium (*bhangar*) and the low grounds through which the rivers now flow, which we may call the new alluvium (*khadir*). The same conditions exist in the whole of the Gangetic Plain. In the Dun the old alluvium consists at the surface of clay, and the new alluvium of shingle and sand. Mr. Milward

refers to a former lake period to account for the deposit of clay of the old alluvium, whereas I have considered this to be a river deposit, laid down by floods at a time when the beds of the rivers were at a very much higher level than at the present time, the whole Dun being in consequence a sheet of water or at least a swamp temporarily during the flood seasons. It makes little difference, however, whether we consider the old alluvium to have been laid down in a lake or by flooding from the rivers; the result in either case would be the same, namely, a deposit of clay over the whole surface of the Dun. The next thing is to consider the cause for the beds of the rivers being now so very much lower than the old alluvium, leaving this high and dry without any possibility of flooding. Geologists, as far as I can ascertain, attribute the lowering of the river beds to a gradual subsidence of the land at the Ganges Delta, for which the results of borings have supplied ample data. The lowering of the Ganges Delta would increase the gradient of the rivers and naturally result in vertical erosion, thus leaving the rivers at a much lower level than they were formerly. Owing to the oscillations of the rivers the land has been eroded laterally, gradually reducing the area of old alluvium, so that at the present day we find the rivers between high banks of old alluvium which may be very far apart according to the extent of lateral erosion, and flowing through a large area of low land. This low land is more or less subjected to flooding and is being constantly eroded and again re-deposited, forming the low alluvium, which is therefore a more or less recent topography, which as it forms becomes rapidly clothed with vegetation, which develops up to the mixed forest stage.

Now, from the fact that these mixed forests are on water-transmitting strata, and the sal forests are essentially on clay beds which retain more moisture, Mr. Milward draws the conclusion that the mixed forests do not develop further and give place to sal forest. He seems to consider that the sal forests in the Dun show a decided preference for the clay deposits and the mixed forests for the water-transmitting deposits without any consideration of high or low alluvium. I believe that the sal forests are

essentially on the clay deposits because these are the high or old alluvium and the mixed forests are on the water-transmitting deposits because these are the low or new alluvium, and that this distribution has nothing to do with the fact that the clay beds retain more moisture. Had the high alluvium been of water-transmitting strata, I believe it would now be under sal forest, and were the low alluvium of clay deposits I believe it would still support mixed forests.

Sal evidently extended from the hills on to the high alluvium as the water level became lowered by the lowering of the river beds by vertical erosion, but through the mixed forest stages and not directly. By lateral erosion the high alluvium with its sal forests has been reduced considerably in area to be replaced by low alluvium with its mixed forests. That these mixed forests on the low alluvium have not yet given place to sal may be correct, but for other reasons than that sal prefers the clayey deposits. The fact that these low alluvium strata are water-transmitting is not, I think, the barrier which keeps out sal, for it is well known that the best sal forests are on water-transmitting strata, in support of which I quote the following from Brandis:—"The sal tree does not thrive on heavy binding soils; it requires a loose soil which transmits water freely.....Sal forests are generally found on sandstone, on conglomerate, the gravelly and shingly soil of the Sub-Himalayan tract, and the tree attains perfection where loose water-transmitting soils are mixed with a large proportion of vegetable mould." Sal is found in the Dun up to the top of the Siwaliks and extending to the plains on the Saharanpur side often with the water level at a great depth. Why sal has not yet extended to the low alluvium in the Dun it is not easy to say, and the subject requires further investigation. It may be that the flood level is still too high, and that the necessary conditions to render the locality suitable for sal can only be brought about by a further lowering of the river beds, or that there is a want of humus in the soil, or that frost is too severe. If there are areas of low alluvium which have been left high and dry for a considerable time by the further lowering of the river beds

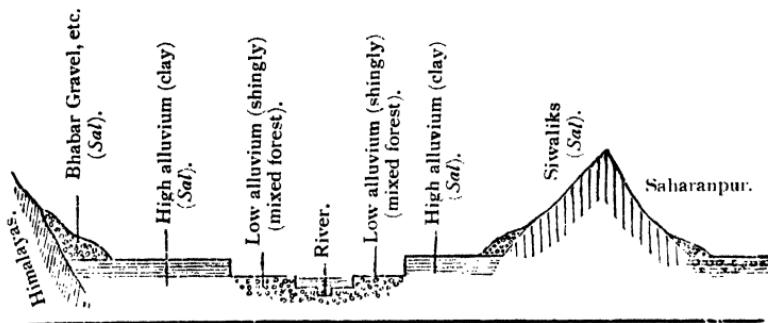
it may be that sal has not had an opportunity of reaching them owing to the heavy nature of its seed.

In connection with this subject there is an interesting article by Mr. F. A. Leete in the September 1903 number with reference to the Kheri Trans-Sarda forests. He shows that in Kheri there are two distinct types of sal forests which he calls high level sal forests and low level sal forests, both being situated on alluvium well above the present beds of the rivers, there being also a low alluvium supporting mixed forests as in the Dehra Dun. This is interesting because it seems to point to a further stage than exists at present in the Dun, namely, sal forests on a level or terrace intermediate between the high alluvium and the low alluvium.

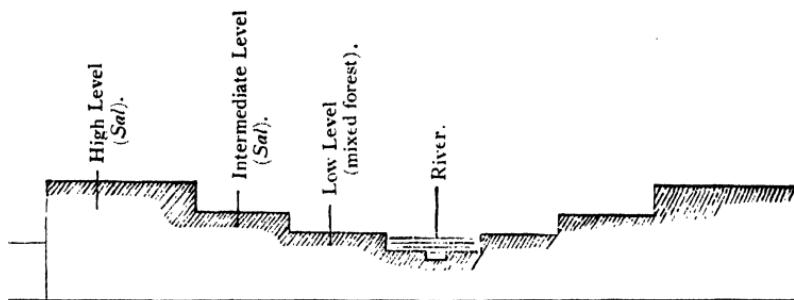
In other words, in the Dun there are, broadly speaking, two terraces, the high alluvium with sal forest and the low alluvium with mixed forest, whereas in Kheri there is a high alluvium with good sal forest, an intermediate alluvium with poor sal forest, and a low alluvium with mixed forest. Taking into consideration the conditions in Kheri it appears probable that by the further lowering of the river beds in the Dehra Dun the present low alluvium with mixed forests will gradually change to intermediate alluvium with sal, as in Kheri.

It should be noted also that in Kheri the best sal forests are on the high alluvium and the poorer sal forests are on the intermediate alluvium, evidently a sign that the latter locality is a more recent topography not yet in a condition suitable for the best growth of sal. It appears that the lower the water levels the better the growth of sal, and as the water level becomes lower the condition of the sal forests on the intermediate alluvium will improve. It will be interesting to maintain records of the water level in these forests; as such data may be of use after a number of years in showing whether there is any improvement in the growth of sal simultaneously with the lowering of the water level, but of course long periods must elapse before any appreciable difference can be detected.

DIAGRAMMATIC SECTION ACROSS THE DEHRA DUN.



DIAGRAMMATIC SECTION IN KHERI (OUDH).



In conclusion I still believe the sal forests, where they occur in the Dehra Dun, to have originated through the mixed forest stages, although it would appear from Mr. Milward's note that the mixed forests on the low alluvium have not yet given place to sal "except in one or two instances where sal has extended from the clayey plateau to the lower ground;" but as the river beds become further lowered by vertical erosion I have little doubt that the mixed forests will give place to sal, thus giving the intermediate class of forest as seen in Kheri.

B. O. COVENTRY,
Deputy Conservator of Forests.

REPRODUCTION BY SUCKER SHOOTS.

Similar experiments to those described in the article on "Sucker Shoots" in the April *Indian Forester* (Vol. XXX) were carried out this year on a small scale in the Dehra Dun Division.

Just before the rains some of the roots of standing sal, sandan (*Ougeinia dalbergioides*) and shisham (*Dalbergia Sissoo*) were exposed and also roots belonging to stumps of recently-felled trees of the same species.

The results, which may prove of some general interest, are here briefly given :—

- | | | |
|-------------------|-----|---|
| Sal, standing | ... | No sucker shoots produced. |
| Sal stumps | ... | No sucker shoots : only coppice shoots. |
| Sandan, standing | ... | Result unsatisfactory : only two trees
produced one sucker shoot each. |
| Sandan stumps | ... | No sucker shoots : only coppice shoots. |
| Shisham, standing | ... | No sucker shoots. |
| Shisham stumps | ... | Very numerous strong sucker shoots and
very plentiful coppice-shoots produced,
which latter are, however, weak as
compared with the sucker shoots. |

E. R. STEVENS.

THE KISTNA FLOODS OF OCTOBER 1893, ETC.

In the note under the above heading which appeared on page 615 of the December (1904) issue, planting operations are suggested in order to reduce disasters of this nature. Such planting operations would have little effect if carried out in the Kistna District itself. It is in the Bombay Presidency along the course of the Kistna river and its tributaries and over their catchment areas that forests are required. I am not acquainted with those localities and am ignorant of the state of the vegetation there, but I have good cause to remember floods similar to those under discussion which occurred in August 1896 and which originated in the Bombay Presidency.

The S.-W. monsoon had entirely failed and there was grave fear of famine, which, as is well known, proved only too well founded, since the famine of 1897 ensued.

Over the catchment area of the Kistna however very heavy rain fell continuously for three or four days (quoting from memory and subject to correction, 53 inches in four days), with the result that the whole tract of land between Bezwada and the sea, about 500 square miles, was inundated.

CECIL E. C. FISCHER.

CHATRAPUR, GANJAM DISTRICT :

January 5th, 1905.

THE DIMENSIONS OF BAMBUSA ARUNDINACEA.

It may perhaps be of interest to the readers of the *Indian Forester* to hear that a bamboo culm, felled in November 1904 at Pattažhi in Central Travancore from a clump of *B. arundinacea*, measured $12\frac{1}{2}$ feet long, and had a girth of 20 inches at its middle, the diameter of the cavity being one-third that of the culm. The whole clump consisted of 112 shoots, of which 75 were extracted.

Besides the one above-mentioned there were six shoots of 118 feet long. This particular shoot is said to be three years old; but as a shoot accomplishes the whole of its growth in height and thickness in the first few weeks of its life, the age is perhaps of little consequence. I may mention that this clump (as also those in the vicinity) had remained untouched since its exploitation in 1895.

It would prove of interest if readers of the Magazine could inform me whether shoots of this species are known to have attained greater dimensions.

CAMP PATTAZHI,

TRAVANCORE :

3rd November 1904.

M. VELU PILLAI,

Forest Ranger.

REVIEWS AND TRANSLATIONS.

THE PROMOTION OF ABORICULTURE IN AJMER-MERWARA.

Last year in an article on Roadside Arboriculture in India* we drew attention to the fact that the Government of India had under consideration the subject of the maintenance of avenues of trees along roadsides in India. In earlier days this matter was as much a feature of British administration as the construction of the roads themselves; but in recent times, as those who have had opportunities of travelling all over the country know full well, the matter has fallen into almost complete abeyance, and curiously enough the man the most opposed to the practice is in many instances the road-maker or up-keeper himself. But the blame cannot be laid fully upon his shoulders, for many a District Officer, although it would require but a word from him, entirely neglects such matters. How often is it possible to see recently planted trees with their bamboo matting enclosure overthrown and the young trees browsed down by passing cattle : an almost criminal waste of money, leaving other considerations out of the question, but which no one responsible pays any heed to save perhaps to order a new plant to be put in the following year, which shares the same fate. We are of opinion that this wanton destruction of roadside plants upon which Government money has been laid out should be met by a really severe deterrent penalty. Through the courtesy of the Hon'ble the Chief Commissioner of Ajmer-Merwara we have received a copy of a Report, drawn up under his orders by the Forest Officer of the Agency upon this question of roadside arboriculture ; a perusal has shown that here, at any rate, the question is being approached in the proper spirit.

Before the year 1893 there were no rules for planting trees on roads, and very little money was spent in this direction. The old

avenues had been woefully neglected. The subject first attracted the attention of Colonel Biddulph, Commissioner, Ajmer-Merwara, in 1892. A list of roads was made out and measures taken to start the work. Owing to the failure of the rains no practical action was however taken. In July 1893 Mr. Martindale, who had succeeded Colonel Biddulph as Commissioner, convened a special meeting of District Officers to consider the best way of improving roadside arboriculture. The Forest Officer was a Member of this Committee. It was decided to place the whole of the avenues under the Forest Officer, who would annually plant a certain length of roads, radiating from the principal centres—Ajmer, Beawar, Nasirabad, Kekri, etc.,—according as funds became available.

The following general instructions were issued :—Plants to be 3' in height (subsequently raised to 4') ; distance between plants 30', giving 352 trees to a mile ; best tree to plant was *shisham* (*Dalbergia latifolia*), then in order *nim* (*Melia indica*), *bar* (*Ficus bengalensis*), *jamam* (*Eugenia operculata*), and *babul* (*Acacia arabica*) ; the plants to be obtained from the Forest nurseries and paid for ; a scheme of operations to be drawn up annually and submitted for sanction ; funds to be allotted annually to the Forest Officer, on requisition, up to limit available.

Work was commenced on the above lines and continued up to 1898. A number of difficulties cropped up over the watering of the young plants, species being planted on the wrong soils, insufficient protection from traffic and cattle, indiscriminate use of plants of all sizes, etc., and these defects became so serious that in 1898, at the instance of the Forest Officer, the Commissioner suspended all planting for a year. The whole system was then revised, and great success is said to have attended the plantations undertaken since 1899-1900. Under the existing arrangements the amount of new planting is determined by the funds available after providing for the maintenance of the existing plantations, a yearly annual plan of operations being drawn up. The transplants are at least 4' high and not less than two years old ; the distance between the plants is 50' thus giving 210 trees to a mile ; the

best avenue trees have been found to be *nim* and *kalia siris* (*Albizzia odoratissima*). These suit all kinds of soil and are not attacked by white-ants. In *reh* soils tamarisk is most suitable and for loose sandy soils, *shisham* and *arusa* (*Adhatoda Vasica*). *Ficus* cuttings were tried in the past, but died in large numbers. The trees are planted at the beginning of the rains. If these latter do not fail and the plants are well protected and regularly watered, they will be completely established within five to seven years. All the avenues after the famine of 1899-1900 have been planted on the lines above indicated and are in a very flourishing condition.

The great difficulty to be faced in roadside avenue planting is the question of an efficient tree-guard. The experience gained in Ajmer-Merwara shows that (1) For ordinary purposes wood enclosures made of 4 uprights 5' high with 3 cross pieces of wood 1½' apart interwoven with thorns, total costing annas 8, are sufficient. (2) In the vicinity of towns and big villages enclosures of dry stone masonry or of *katcha* bricks plastered with clay and a coping of morum are used. They are 4' high, 1' thick, with a diameter of 4'. They cost Re. 1-3-0 each. Blanks are at once filled up.

We see in the existing system in Ajmer-Merwara the results of eleven years' experience, and the present methods and attention paid to this extremely important matter appear to be commendably thorough.

In the case of roadside arboriculture one point should not be lost sight of, and that is that the expenditure to be incurred is not an endless reoccurring one. Once the roads have been planted up and the young trees have established themselves, the expenditure on further planting and maintenance drops out of the budget.

We trust that the action taken by the Government of India will result in restoring to the old roads and giving to the new ones of the country those fine avenues, now fast disappearing, which we inherit and enjoy owing to the far-sighted policy of earlier British Administrations in the country.

*'TREES.' VOLUME I—BUDS AND TWIGS.

BY H. MARSHALL WARD, SC.D., F.R.S.

This work will form a valuable addition to the library of anyone who is interested in the fascinating study of nature as revealed by a first-hand acquaintance with the living plant in its natural state. It is the first of a series of volumes whose purpose is to provide students of Forest Botany with a guide to the study of trees and shrubs from the point of view of the out-door naturalist, while at the same time interesting them in a somewhat closer examination in the laboratory of the objects observed out of doors. This volume ably fulfils its purpose, and will afford a refreshing stimulus to the student to observe and think for himself.

The work is divided into two Parts—I, General, and II, Special. In Part I, the author deals comprehensively with the shoot system and its differentiated parts, describing in turn, with numerous examples, buds, their position, arrangement and structure; bud-scales, the arrangement of leaves in the bud, the opening of the bud and extension of the shoot, different kinds of shoots, the tegumentary system—epidermis and its outgrowths, and periderm (cork)—leaf-casting and the formation of leaf-scars, twigs, lenticels, and finally certain accessory characters of twigs (hairs, bristles, prickles, spines, tendrils, etc.). Part II is of a more special nature, and consists of a classification of the trees and shrubs commonly met with in England, according to the characteristics exhibited by their buds and twigs. Even to merely outline the system would be beyond the scope of this review ; suffice it to say that the classification has been most carefully worked out and the arrangement is clear and concise, the language being free from unnecessary technicalities.

The book is admirably illustrated throughout. Some of the illustrations have appeared elsewhere, but a large number are new ; they form an indispensable adjunct to the text.

* 'Trees,' a Handbook of Forest Botany for the Woodlands and the Laboratory, by H. Marshall Ward, Sc.D., F.R.S., Volume I—Buds and Twigs. Cambridge Biological Series, Cambridge, at the University Press, 1904. Price 4s. 6d.

We may conclude by quoting a passage from the author's Preface in support of the plea that the branch of study revealed to us in the present work is no mere amateur's hobby, but may be profitably pursued by the expert: "Rarely have I experienced a greater surprise, or enjoyed days of field-work more, than during a fortunate visit many years ago to one of the greatest Forest Botanists ever known to Europe: he could recognize practically every species of tree, shrub, or bush we met with, from the smallest piece of twig with one or two internodes on it, or from a mere fragment of its wood or bark or leaf, and if anyone is inclined to regard such knowledge as barren, let him look into the work that Robert Hartig accomplished during his lifetime."

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

A VISIT TO MAURITIUS.

(Continued from p. 223, Vol. xxx.)

In a former article I gave some account of Mauritius. Amongst other idiosyncracies the Colony has a most peculiar system of weights and measures, yet, strange to say, whenever Nature vouchsafes her a good crop and abstains from disasters Mauritius does not fail to wax fat, irrespective of her peculiarity in this respect. The ton, cwt., pound, kilogramme, and apothecary's weight are all used. Sugar may be grown in tons of cane to the acre, squeezed by the 1,000 kilos. of cane, sold by the 100 lbs. of crystals, transported by the railway ton weight, and shipped by the ship's ton measure. Land is measured by the acre and by the arpent, the ratio being 43'45, but surveying is done with a chain of 100 French feet, the latter being slightly larger than the English foot. Maps are drawn to the scale of generally 2,000 French feet to the French inch, but English-made maps are mostly in English inches and miles. The relationship between two such maps of the same land is by no means obvious to the non-professional. There are other obsolete



Photo, F. Gleadow.

Sideroxylon Grandiflorum (?) ("Tamalacoque"). Girth 17 ft. (Mauritius).

measures quite in keeping with the obsolete English ones of which metric agitators make so much capital. The legal coinage is the rupee divided into cents, but there is a collateral theoretical coinage which has no visible means of existence, yet is used every day. This is the *piastre* divided into *centièmes*. The piastre replaced the obsolete dollar in the hearts of the people. Mauritius has at times been so rich that nothing less than a dollar was good enough to throw about, and to this day you can bet in dollars or piastras and pay at the rate of two rupees. An auction is a confusing function at first. The auctioneer speaks English, his clerk French, and they simultaneously shout the last bid in the two different coinages. Thus while the auctioneer is bellowing "fifty-two, fifty-three, fifty-three rupees and a half" the clerk bawls "vingt six piastras, vingt six et demie, vingt six piastras soixante quinze centièmes," and so on. As they frequently pronounce *piastre* like *piaasse*, the greenhorn is liable to hear *pièce*, fancy a *pièce* is a rupee, and pay just double what he intended. The two-cent piece is called a *cash* and is thus one *centième* or the hundredth part of a dollar or piastre.

The cloth-sellers prefer to sell by the ell or *aune*, but they keep a metre measure, which they reduce by so much for the yard, and increase by so much for the ell. Timber is sold by the foot cube, English or French, and by the foot run, English or French, according as it is home-grown or imported, but never by the metre. Fire wood is sold by the cord, or stack of $2\frac{1}{2} \times 4 \times 8 = 80$ French cubic feet. Charcoal is sold by the sack, and the sack is measured not in cubic feet but in kerosene tins, a new standard that has not yet been legalised.

Labour is paid much more than in India, no rank in life getting less pay than fifteen or twenty rupees a month, while dock-labourers during the season can command three or four rupees a day. The mass of agricultural labour is Indian, but there are large numbers of negro creoles and mixed races. The negro keeps off the land as a rule, his ancestors having had enough of it, and his class considering it rather a degrading occupation unless he is himself the owner.

The Negro in all countries is built that way. He would rather stroll round as a gamekeeper with a gun, poach regularly, pilfer as regularly, and get roysterous whenever liquor is available, than do any form of steady labour. Both Negroes and Indians will work most pluckily on exceptional occasions, such as getting in the crop against time, or accumulating a big week's wages for a heavy New Year orgie. They will in such weeks do three to four times the normal amount of work, and the negro element especially will spend every farthing of the wages on debauchery. Many of them drink all they earn, leaving the wife to maintain the house.

The climate of Mauritius varies with circumstances. If you have standing wood to sell, the climate is far too moist ; but if it is your neighbour who proposes to cut his forest, the climate is desperately dry and the country in danger of being ruined by the drying up of its streams. As a matter of fact, the streams throughout have seriously diminished and the climate is not nearly so moist as it used to be ; but it differs considerably according to localities. On the East Coast the rainfall is heavy, on the West it is light. On the slopes of the Bamboo range it is said to reach 200 inches, whilst the West Coast in some years only gets about 12 to 20 inches. Curepipe, the highest town, situate about the centre of the Island, is a place where books are ruined, clothes always damp and boots go mouldy. The houses are mostly wood and have no fireplaces, but the damp is sometimes cold and raw in the winter months, May to July. Port Louis, the capital, is on the West Coast, habitable in winter, but steamy and feverish in the summer—in fact a climate similar to that of Bombay. It is about as far south of the equator as Bombay is north, and is consequently cooler, but is so little desirable as a residence that it resembles the City of London in the crowds that enter and leave it by train morning and evening, while at night the poor are almost its sole population.

The forest system is rather complicated. Besides private forests proper and Crown forests there are three other classes of land generally devoted to forests, and of these three two may sometimes belong to private persons while the third is often leased

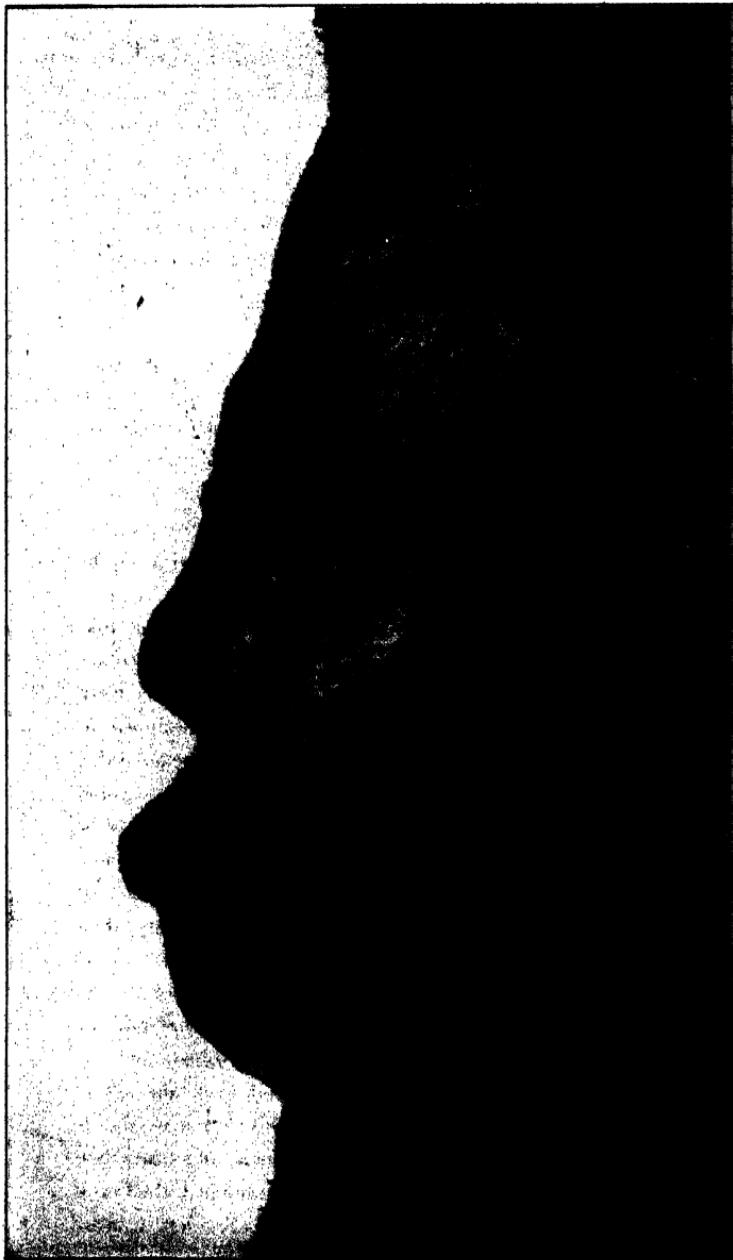
to them. In the beginning the whole of the soil belonged to the Government, which gave or sold grants of land. The principal conditions attaching to these concessions were—

- (a) the clearing and cultivating of the land ;
- (b) permanent residence of the owner ;
- (c) maintenance of a fourth or fifth of the area under forest ;
- (d) maintenance of the upper third or two-thirds of all mountains under forest ;
- (e) maintenance of a belt varying from 50 to 100 feet along both banks of streams ;
- (f) maintenance of a belt called the “*Pas géométriques*” (50 “steps” of 6 feet !) all round the Coast for military purposes ;
- (g) education of all slaves as Christians ;
- (h) slaves not to work on holidays and Saints days ;
- (i) labour to be provided for road-mending or other public purposes at the rate of two days in the year per slave ;
- (j) payment of a nominal rent, perhaps an ounce of coffee and a fowl or two per acre per annum.

It results from clauses (c), (d), (e), and (f) that as the extent of the legal grant was $156\frac{1}{4}$ or $312\frac{1}{2}$ arpents almost every land-owner in the Island ought to have had some area of forest which he was obliged to conserve in the interests of the Colony at large. The conditions were grossly and continually disregarded, but that does not affect the principle, and the classes still exist. The Government forests thus comprise Crown forests proper, *Pas géométriques*, River Reserves and Mountain Reserves. The last two, being for the common benefit of the Colony, are not available for fellings, grazing, etc., but only in general for shooting and fishing. The *Pas géométriques* are almost entirely leased to private persons for purposes of plantation, grazing, bathing, residence or agriculture, notwithstanding that the law has always forbidden the last two, but a law is no good if it is not enforced. The Crown forests proper are of two kinds, the old original forests that have been more or less plundered or utterly ruined; as the case may be, and the lands that have been bought back from private owners during

the last twenty years or so. These last lands are sometimes good forest, but in most cases they had been cleared and perhaps cultivated by the owners, so that they now largely consist of wretched open scrub. The Pas géométriques were originally a military zone to allow of rapid transit between the numerous batteries round the Coast, and to provide some grazing for transport animals. At that time wood was a drug in the market, not to say a nuisance, yet the Pas géométriques were not to be cleared, and they were declared imprescriptible. Later, it was distinctly laid down that they were to be kept planted whenever they became bare. Notwithstanding strict and repeated laws, persons of influence continued to obtain grants or formal recognitions of prescriptive rights for themselves or their hangers-on. Latterly a new law has been passed which gets round the old law of impre- scriptibility by means of declaring parts of the Pas géométriques to be "extended villages." As such, they may be cleared, inhabited, cultivated, or otherwise disposed of like any waste land.

The private forests comprise Mountain and River Reserves, besides those which the owners may do as they like with free from any restraint. Mountain and River Reserves are a property subject to a heavy servitude. They belong entirely to the owner, soil and trees, but he may not cut a tree or a branch without first obtaining special permission. His enjoyment is thus practically limited to the chase, with very rarely the permission to utilise a dead or broken tree. There has recently been a proposal to enlarge the privileges of the owners by letting them work their mountain and river reserves regularly under the supervision of the Forest Department. It is perhaps hard that they should be so limited, but they have only themselves to blame. They have no right to claim any more indulgence than is sanctioned by existing practice, and after seeing the moral tone of the public service and of the people from which it is drawn, I have no hesitation in saying that any such concession would only be regarded as a facility for further abuses. The State must eventually acquire those Mountain Reserves that now belong to private owners, and it would be most injudicious to alter anything in the meanwhile.



Photo, F. Gleadon.

The Camizard Mountain (columnar basalt) Forest and Sugarcane, Mauritius (telephoto view).

As regards private River Reserves it is very difficult to know what to do. They are surrounded by crowds of pilfering coolies, and many of the estates do all in their power by fair or foul means to reduce them. The width of the forest strip along streams is fixed by law at 10, 25, or 50 feet each side from the water's edge, according to the quantity of water flowing in them. Whenever a dry year, etc., offers the opportunity the owners claim to have the flow measured, and often succeed in getting the legal width reduced. When the basin of a 50-foot stream is well cleared of forest growth the flow naturally diminishes, and the reserves are reduced to 25 feet. This reduction further diminishes the flow, and another opportunity occurs for remeasurement. The reserves are reduced to 10 feet, and that is about the end. Marshes, the natural protectors of streams, are drained and cultivated, so that for many years there has been a continual reduction in the flow of all the streams in the Island, and many mills have had to close for want of water for their machinery. Estates are being cut up into innumerable small holdings of an acre or two, or even less, so that effective protection is becoming more difficult. It thus becomes an open question whether the State will be able to effectively preserve these strips, or whether they are bound to disappear in a future not very remote. In the latter case it might be advisable to sell the servitude to the owners at once, but such a sale would have to be compulsory, for though a few honest Estates would be glad to acquire and maintain them, the majority would prefer to destroy them gradually. In any case some would plead that their pecuniary position precluded them from buying their freedom. It is a thousand pities that the old law of 50 and 100 feet was not maintained, but it cannot be re-established. Another old law required owners to maintain the wooded state, but that too has been abolished, and the only existing remedy is to catch the offenders in the act of destruction. It might be possible to revive this last law and to require all owners to *plant and maintain* on penalty of a heavy fine. This would meet the case if duly enforced, but I doubt if the Forest Department would dare enforce it. Just before I left I heard

that an Estate in which a member of Council is strongly interested had been defying the law, but nobody dared to interfere. A large proportion of the forest guards have no other work but patrolling these private reserves. It is a very heavy burden on the Department and a continual temptation to the guards, who cannot afford to be on bad terms with Estate-owners. No revenue is derived from River Reserves, and they are a school for dishonesty, but they certainly benefit the Colony, and I did not see my way to recommend their abolition.

Barring the Pas géométriques and a few exceptional cases there is no grazing in the forests, whether Crown or private, but the fishing and shooting are strictly preserved, and as diligently poached. The less said about the river sport the better, as it consists principally of noosing prawns ; but the shooting is good. The forests contain numbers of a kind of deer resembling a half-grown sambhar or bigger. Stalking is generally impossible on account of the dense mass of raspberries and lantana, so the method adopted is the battue. A few narrow paths are cut for the keepers, and dogs are put in. The owner has invited a large party, who are stationed at intervals, and the game is driven past. There are game laws for a close season, etc., but the owners are the first to break them, and it is notorious that venison is a standing dish at Xmas and New Year, in the middle of the close season. The battue may begin at 5 A.M., and the guests sit sometimes for hours in pouring rain without perhaps getting a shot, but that is a secondary consideration. The real pleasure begins with the dinner and the jovial evening that follows. Stalking is only practised in the rutting season, when the stags are calling. It is looked on generally with disapproval, not because it is unsportsman-like, but because it is supposed to drive away the deer to other pastures much quicker than the battue does ; also no doubt because there is no social gaiety about it. The sporting rights in forests are leased for periods of seven years, but certain men often manage to keep out competitors for as long as they live, either by *camaraderie* or (if there is no public path) by preventing access to the land. The State revenue from sporting rights perhaps averages Rs. 5,000 a year.

The contrast between these forests and the burnt and overgrazed jungles of, e.g., Bombay, is most striking, the one being full of fine young seedlings, the other merely hanging on to life. Even in Mauritius there are grave examples of areas that were forest within living memory but which have now become too dry to be planted with much hope of success.

The old provisions, requiring the maintenance of a fourth or fifth of the area under forest, and of the upper slopes of all mountains, were dictated by true regard for the interests of the Colony. Unfortunately, there was no adequate agency to carry them out, no proper penalties for disobedience, and if there had been, the community was so addicted to "*camaraderie*" from the highest to the lowest that no restrictive law had any chance of success unless its operation was strictly controlled from home. This control was wanting. The home Government was continually fulminating against the disregard of laws and enacting new ones, but evasions increased to a frightful extent. Another law was made which contained definitions of an absolutely unworkable nature. The Surveyor-General failed to insist on having a law that could be carried out, and chaos supervened. Mountain Reserves and even State forests were cleared with cynical effrontery and with impunity by neighbouring landowners and others. Prescriptive claims to Crown lands were set up and successfully maintained. Government Surveyors were bribed to make over State lands. Mountains were cultivated right over their tops. Stolen lands were sold to second and third parties, so that they could not be resumed without apparent injustice. Those who had robbed most were loudest in their outcries against the injustice of a Government that desired to protect the State property, and they succeeded in paralysing all such efforts. For the last twenty years or so this state of paralysis has continued, so that men who ought to have been very heavily fined or imprisoned have either become practically confirmed in the ownership, or they have sold the stolen lands to others who claim to have bought in good faith. In any case the State has been looted to a shameful extent both in land and in timber. Forests that should have provided large revenues for the next fifty or a

hundred years have been swept in to the pockets of robbers or destroyed deliberately to make room for crops. Much of the land so cleared was found incapable of profitable culture, and now lies nearly bare. In some cases the persons who have plundered the State have sold the land back to Government at high prices or are now attempting to do so. The responsibility for this sad condition of things lies at the door of—whom? The Government can do but little unless a Council will approve a draft law, and that is just what broke down. Suffice it to say that things would have been far worse but for one man, Sir Célicourt Antelme, who did his utmost to insist on honesty regardless of *camaraderie* or other considerations.

The local Forest Department dates back to very early times, but was very small and inefficient until the last reorganisation. It consists of a Director of Forests and Gardens (the Botanical Gardens at Pamplemousses are very fine indeed), two Assistants, eight Inspectors, and about a hundred Forest Guards. Perhaps a third of these guards could be dispensed with if the River Reserves were abolished, as they do nothing but patrol the banks of private streams, but actually I have proposed to increase their number to 134. There is of course a separate office and gardening staff. The Director is paid Rs. 5,000 a year, and the Guards begin on Rs. 15 and 20 a month, which is looked upon as a starvation wage. A few get quarters, but the rest have to hire for themselves. The pay of the Director I wished to raise very considerably, but they seem to have decided that Rs. 6,000 to 8,000 is the most they can pay. Seeing the difficult position that any local Director finds himself placed in, and the practical certainty that he must succumb to local influences when his children have to look to those influences for their prospects, I strongly recommended that the Director should be a stranger to the Colony, but here again local influences seem to be too strong. My recommendation was that Mauritius should be for forest purposes practically attached to India. The Indian establishment would be enlarged by one post, the Mauritius Government would defray the cost, and the Inspector-General would depute a suitable



Photo, F. Glaedens.

Canarium Colophania ("Colophane"). Girth 16 ft. (Mauritius).

Assistant Conservator, 1st grade, or Deputy Conservator, 4th grade, for three to five years or until his promotion brought him more pay than Mauritius was contributing. It would be useful experience for India, Mauritius cannot do better for herself, and there is no real reason that I can see for rejecting the plan.

One rather curious thing in the Mauritius system is the idea of paying a man extra when he really does his work. Of course, if an officer devotes his leisure to writing some useful technical book, etc., it is only fair that he should be rewarded. But in Mauritius almost anything beyond the usual casual routine may be made a ground for extra pay. Thus a Forest Inspector who has a felling going on in his charge may get Rs. 150 a month extra pay and Rs. 60 a month extra horse allowance, although the hours he devotes to the felling are simply subtracted from patrolling or other work. It is the same in all Departments. The extra work of course involves more trouble and responsibility, but after all it is the work for which the officer is paid. The system should be stopped, but Inspectors should also be better paid all round, for their present pay is insufficient to secure the best men.

The illustrations show a telephoto view of the Camizard Mountain which consists of columnar basalt and of specimens of *Sideroxylon grandiflorum*(?), known as 'tamalacoque' and *Canarium colophania*, known as 'colophane' in the Island. The trees depicted girth 17ft. and 16ft. respectively at 6ft. from the ground and have their big branches densely overgrown with *Asplenium nidus* and other ferns; so thick is this arboreal vegetation that a man could easily conceal himself within it.

F. G.

EXTRACTS FROM OFFICIAL PAPERS.

NOTE ON GERMINATION OF TEAK AND OTHER SEEDS.*

I. - TEAK.

1. Teak seed, if not previously prepared, germinate best in the second year after falling from the tree. The result of this feature in the germinating power of teak seed is that double sets of seed beds are required in a nursery, which involves loss of area and extra expense in keeping the beds clear of weed, etc.

2. As the area of the Godhra Forest nursery is limited, it has been found necessary to determine the best method of forcing teak seed, and to do this the seed has been forced by three different methods and the result carefully examined.

3. The first method, under which a large quantity of seed was treated, consisted in laying out the seed in a thin layer on a gravel path and exposing it to the heat of the sun for over two months, the seed being turned every fortnight, so as to expose all sides to the heat. Before the rains set in the seed was sown on raised seed beds, previously prepared, as described at the end of this note. This method was suggested by Mr. Damle, Extra Assistant Conservator of Forests, Nasik, and will be referred to later as Damle's method, No. I.

4. The second method which was tried consisted of putting teak seed in layers about one inch thick in a pit 10 feet square and 18 inches to 2 feet deep with alternate layers of earth of the same thickness. The whole was filled level with the ground, with alternate layers of seed and earth, and then flooded with water every other day, five times. The whole mass was then thoroughly mixed and again watered on alternate days, until the seed showed signs of germination. This method may be called for reference "The Modified Burman method, No. II."

5. The third method consisted of putting teak seed in pits, 4 feet square and 2 feet deep, flooding the whole for four days

* This note was very kindly placed at the disposal of the Hon. Editor by the Conservator of Forests, Northern Circle, Bombay.

and drying the seed on paths for four days by spreading it out in thin layers and repeating the process until the seed showed signs of germination. This may be called the "Local method No. III."

6. The seed used in these experiments was collected in the Panch Mahals, and is therefore local seed. Five hundred pounds or over were treated by each method and 1,000 seeds of each kind were carefully selected and sown in separate raised beds, for the purpose of estimating the relative value of each method.

7. The results observed are as follows:—

(a). All three sets of 1,000 seed were sown on the 4th June 1904.

(b). Rain fell 2 inches and 17 cents on 11th June 1904.

Do.	0	do.	.29	do.	21st	do.
Do.	0	do.	19	do.	4th	July
Do.	1	do.	87	do.	5th	do.
Do.	1	do.	43	do.	7th	do.
Do.	1	do.	58	do.	11th	do.

(c). On the 21st June 1904 one teak seed germinated out of the 1,000 treated under the Local method No. III (the beds containing seed treated under observation, also showed plentiful signs of germination on this date, but not those treated under Nos. I or II).

(d). On the 8th July 1904 all three sets of seed showed signs of germination.

8. After this period the number of seeds which had germinated in each set of beds, containing 1,000 seeds each, were counted, giving the following results:—

Date.	Damle's method No. I. No. of seed germinated.	Modified Burman method No. II. No. of seed germinated.	Local method No. III. No. of seed germinated.
22nd July 1904 ...	65	312	22
29th , , ...	99	335	27
20th August 1904	100	313*	27

* Some plants killed by a cockchafer grub.

9. The beds which were not under observation but sown with the three differently prepared kinds of seed show similar results to the above, except that the difference in the methods Nos. II and III was not quite so marked as in the experimental beds. No. III germinated first both in the common beds and experimental beds. All the beds of seed treated under method No. II gave most excellent results, and roughly 60,000 to 70,000 plants were obtained out of 500 lbs. of seed treated under this method.

II.—KHAIR SEED.

10. Khair seed requires no previous preparation, but germinates readily after a moderate rainfall. It should, however, be sown in raised beds, as excessive moisture rots the seed. Last year 15 bags of khair seed were lost by heavy rain falling on it. This year, to avoid similar failure, the seed was sown and watered by hand ten days before the break of the monsoon. It germinated on the 4th day; on the 10th day after sowing heavy rain fell which, had it not been made to germinate by forcing it previous to the heavy fall of rain, would probably have destroyed it.

III.—AIN (*Terminalia tomentosa*).

11. Ain is sown on a layer of leaves and grass so as to raise it from the ground to prevent it becoming rotten and spoilt by rain. It germinates readily after a good rainfall, and is easy to lift without damage to its root if sown on leaves.

IV.—BIA.

12. Sown in a similar manner to ain without preparation.

V.—DHAWDA (*Anogeissus latifolia*).

13. No good results have as yet been obtained from Dhawda sowings. Sowing on both heavy and sandy soil has failed. The best results, which are at best no good, have been obtained by soaking it for 24 hours in warm water. It, however, transplants easily when once up and with little loss.

PREPARATION OF SEED BEDS.

14. Mr. Damle advised digging or ploughing up the ground for the proposed seed beds in January, so as to expose the soil during the hot weather to climatic influences. This was done in the nursery and the raised seed beds prepared,

at the end of May, with excellent results. Raised seed beds are preferable to sunk beds, though the latter have to be used in the case of transplant beds where watering is done by irrigation.

R. S. PEARSON,
Divisional Forest Officer,
Panch Mahals..

MISCELLANEA.

AUSTRALIAN FORESTRY

COMMUNICATED BY J. PLUMMER.

The importance of forest conservation is beginning to receive increased attention in the Commonwealth, where the revenue from the various State forest lands remains considerably below that obtained in countries possessing far less wealth of timber. In New South Wales the forests, contrary to the popular idea in Europe and America, extend over almost the whole area of the State, excepting portions of the Monaro, Lachlan, Murrumbidgee districts, and the trans-Darling region, where extensive treeless plains occur clothed with salt-bush, scrub, or species of natural grasses. There are at the present time nearly six and a half million acres of forest reserves in the State. In South Australia there are nearly 200,000 acres of forest reserves and plantations; in Queensland, where forest conservation is of recent date, the reserved areas form a total of over three million acres; in Victoria the forest reserves cover a total area of 4,679,540 acres out of 11,797,000 acres of forest country, the balance being mostly timber country difficult of access; in Western Australia a beginning has been made by establishing forest reserves forming a total of over a million acres out of an estimated total of 20,000,000 acres; while in Tasmania about 33,300 acres have been reserved for timber-planting and growing. The total area of forest land in the latter State is about 4,000,000 acres, and it has been estimated that the forest lands of the Commonwealth cover an area of over 60,000,000

acres. The trees met with are chiefly species of *Eucalyptus*, *Angophora*, and other genera of the order Myrtaceæ. The prevalence of the eucalypti, and the large extent covered by the forests, give the country a rather monotonous aspect ; but the park-like appearance of the open forests and the beauty of many flowering shrubs win admiration in spite of the sameness of the trees ; while even the dull, greyish blue of the foliage of the gum trees, when relieved by the yellow blossoms of the wattle, including the graceful myall, or the beautiful and shapely kurrajong, is not without its attractiveness. The trees are, for the most part, straight and cylindrical in the trunk, and when full grown, their first branch is at a considerable height from the ground. The roots of the eucalyptus often lie at no great distance from the surface soil, an adaptation of nature to the peculiar climatic conditions of the country. The finest specimens of many of the timber trees, those yielding the most valuable timber, are found on ridges and hill sides, in places frequently too rough and stony for cultivation. In Western Australia the most valuable indigenous timbers are the jarrah, twart (or torart), sandal wood, karri, and several others. In Queensland cedar timbers are abundant ; also in the northern portions of New South Wales, some of the logs obtained being of enormous size. One characteristic feature of Australian hard-wood trees, of which there exists an almost endless variety, is the great size of the beams which may be obtained from them, as well as for the extreme toughness and durability of their wood ; the grey ironbark having a resistance to breaking equal to 17,900 lb. per square inch, as compared with a mean of 11,800 lb. for English oak and 15,500 for teak. None of the other timbers have so high a resistance to breaking as this description of ironbark, but nearly all the varieties have a greater strength than oak. The quality of the wood is materially influenced by the soil on which the trees grow, while the absence of branches for the greater portion of the height enables the timber to be obtained to the best advantage ; and as full-grown trees of most varieties are rarely less than 100 feet high, with corresponding girth, the quantity of timber obtainable from the virgin forests is very large. In New

South Wales the timbers of commercial value, many of which are found in the other States, include white or she-ironbark, narrow-leaved ironbark, broad-leaved ironbark, mugga, or red ironbark, blackbutt, white mahogany, tallow-wood, spotted gum, grey box, red mahogany, grey gum, forest red gum, Sydney blue gum, and turpentine, the latter resisting the attacks of white ants. One of the most useful trees is the red cedar, the wood of which, somewhat resembling mahogany, is well adapted for the finer kinds of cabinet-makers' work. Some of the cedar trees grow to immense size, as much as 2,500 cubic feet of valuable timber having been obtained from a single tree. Many of the woods of the minor-trees are beautifully grained, and capable of receiving the highest polish, while others are fragrantly perfumed. These woods are adapted to the finest description of cabinet-making, and it is strange that their merits should have so long escaped attention. Amongst these trees may be mentioned the rosewood, tulipwood, yellowwood, white maple, white beech, myall, marblewood, mock orange, and many others. Besides their use for cabinet-making, many of the brush timbers are of great utility for the rougher kinds of carpentry; while some, both hard and soft woods, are admirably adapted for coachbuilders' and coopers' work. "Colonial deal" is an excellent timber, and is obtained in very large scantling, the tree frequently reaching 120 feet in height. It is soft, close-grained, easily wrought, and remarkably free from knots. Its use therefore is extensive for cabinet-makers' work and house fittings. The value of the exports of Australian timber, dressed and undressed, from Commonwealth ports in 1903 was £745,490, of which the undressed timber, chiefly from Western Australia, represented £739,317.

NEW SOUTH WALES HARDWOODS FOR STREET PAVEMENT.

The question of a proper material for road-making and street pavement is one which every large Municipality in India has seriously to consider. The introduction of electric traction has,

in a great measure, revolutionised the conditions in cities which had already begun to feel the strain of a heavy horse and cart traffic consequent on an increasing prosperity, an increasing population and, yea, an increasing luxury. The lotus-eating days are over. The days of the soft pad of the elephant and the camel and of the slowly moving cumbersome wain are gone. Life, be it spent in the pursuit of commerce or mere luxury, is strenuous and locomotion is useless unless maintained at high speed. It is necessary to state the obvious in dealing with a matter which has puzzled Engineers who have been successful in solving intricate problems of drainage and water-supply. During the *régime* of Mr. M. C. Murzban, who may perhaps be accepted as the greatest expert in India in street roads, Bombay had probably the best streets in India. There was a plentiful supply of good material at hand and labour was cheap and intelligent. Yet we find Bombay now dissatisfied, and experiments are in train to treat the principal roads with oil and tar, to prevent the dust resulting from abnormal wear and tear. In Madras they are also in trouble with their roads, the worst perhaps in all the capitals; and in Calcutta there are loud cries of the failure of moorum. In considering the whole subject, we have been struck by a deficiency which, to say the least, is remarkable. In many large cities of the world outside India wood is largely used with success for street paving; but it does not appear to have entered the heads of any of the larger Municipalities in India to adopt a means as old as civilisation but as effective as ever. The Howrah Bridge, at Calcutta, over which there passes a traffic in volume and weight second only to that of London Bridge, is floored with wooden battens, and they have proved so economical and enduring that the wonder is that all the approaches to the Bridge are not treated with like material in the form of wooden blocks. Wood, as a paving material, is comfortable, sanitary and decent, and, after the initial cost has been overcome, much more economical than any other material. In the great and beautiful city of Calcutta wood-paved streets would be a boon to the Municipality and a blessing to the inhabitants. Life in the large thoroughfares

like Chowringhee, Dhurrumtollah, Old Court House Street, and Bentinck Street has been made hideous by the jangle of the electric cars, the rattling of gharries over the rough ill-cut cobbles with which the tramway track is paved, and the vibration of all this heavy traffic. During the hot weather, when the wind is high, people are blinded by dust. When it rains, or the streets are watered from the public hydrants, the road material forms a clayey puddle and a danger to the pedestrian, to the cyclist, and the horseman. From whatever point of view, therefore, the present conditions are unsatisfactory and should not be allowed to continue when there is a satisfactory solution of the difficulty at hand.

Having decided to experiment with wood, the next point to consider is the species to be employed, and there appears little doubt that the hardwoods of Australia, and particularly those of New South Wales, which can be procured in abundance at a rate impossible for even the produce of our own forests, are the best. They have stood the test of experiment; and it may be interesting to mention that in Colombo, where the climate in summer differs little from that of Calcutta, and the mode of life is much the same, the Public Works Department are strong advocates for wood paving. It has been found by experience both in Australia and England that the Australian hardwoods wear better than pine or plain deal, and are more hygienic from the fact that they are less absorbent than soft woods, and do not easily become greasy. Even when laid in connection with electric tramways, it was found that the wear of these woods against the rails was better than other woods, was clean, noiseless, easily scavenged, and gave no trouble from expansion. Anything more ideal could hardly be wanted for Calcutta, where the electric cars have brought nothing but trouble in their wake.

In Australia, the testimony to the value of wood paving is very high. The climatic conditions there are not unlike those in India. They have sudden and great changes of temperature. In summer the atmosphere is hot and dry, and during the rains the humidity is heavy. Nothing could be more trying to a woodpaved

road, yet the City Surveyor of Sydney says that making full allowance for depreciation and contingencies the minimum life of wood pavements may safely be considered as about fifteen years. Mr. MacCabe, the Calcutta Corporation Engineer, whose life has been made miserable by moorum, will probably rub his eyes and never be happy till he gets Blackbutt, Blue Gum, or Red Mahogany for his main roads. In New York they have found such answer well, for, as one Engineer expresses it, "it is not a case of preserving wood, but of wood preserving itself."

As the question of cost is likely to frighten Indian Municipalities who have an exaggerated notion of the expensiveness of wood, we may at once say that comparisons between the cost of hard-woods and macadam show materially in favour of the former. The annual expenditure for repairs during the lifetime of a pavement must necessarily be a variable item, although it must obviously be less for hardwood than for macadam, which so readily crumbles. In addition to this there is the considerable advantage, especially in busy carriage ways, of the thoroughfare being less frequently closed for renewals, which is a matter of great importance to business-people, shop-keepers and others.

In the matter of hygiene there can be no question of the superiority of the timber roadways. They are less absorbent than stone-metal and do not soak up the sewage of the streets. Given therefore ordinarily good surface drainage in Calcutta, streets so paved should never become greasy and slippery and, on the other hand, never accumulate the particles of dust which are thrown up in the air to the destruction of our pulmonary tissues.

A series of observations made by the London police during fifty days in the busiest streets of the metropolis gave the following results :—1,066 horses fell on asphalte, 719 on granite, and 542 on wood. These results are confirmed by the well-known report of Colonel Haywood, formerly City of London Engineer, who stated that horses might be expected to travel 132 miles over granite, 191 over asphalte and 446 over wood, without accident. He also noticed that horses falling recovered their feet more easily on wood than on either asphalte or granite, and that

the accidents were much less serious. Wood is undoubtedly the material most approved by the public, whose demand for a noiseless pavement is not likely to be relaxed. Business is impossible and residence distressing in a busy street paved with material on which traffic produces a continuous clatter, like in Old Court House Street over the tramway cobbles. Wood or asphalte are the only materials which approach the ideal of a noiseless pavement, and between the two in that regard it is difficult to decide.

A. M. I.C.E.,
in *Indian Engineering*.

NEW WOODS.

Continuing our observations on the outlook for the development of the West African timber trade, after explaining how mahogany has commanded the premier position as a furniture wood, we must now consider what possibilities there may be for new and untried timbers.

We have shown that mahogany contains within itself possibly more attributes as a par-excellent material for furniture construction and for high-class fittings than any other wood ; the position has not been attained by a mere decree of fashion, but rather by its abundance and relative cheapness, combined with a beauty of appearance and a capacity for sustaining a high finish and polish. It is not too difficult to season nor to work ; further, when made up it is not liable to warp and twist ; another important factor in its favour is that its specific gravity is not extreme. What then are the conditions which must determine the successful introduction of strange woods ?

If they are only equal to those which they seek to supplant, they must, in the first place, be cheaper ; if they become supplementary they should be at once competitive ; in addition, there should be some reasonable guarantee as to the continuity of supplies. Thus pitch pine did not displace Danzig and Memel fir logs because its price was higher, but rather by its cheapness and better specification.

If a new wood has any special beauty of colour or figure, even if the price is higher, it may command a limited market, as the country is not overstocked with prodigal millionaires, and if any great consumption of any wood is to be stimulated, it can only arise from the requirements of the greater number who have only limited pockets.

We have, during a long course of years, taken every opportunity of carefully examining the many sample shipments of woods which from time to time have come forward; and it is surprising to find how few can compare with the recognised woods of the market. It might add force to our remarks were we tempted to name in detail the varieties in our mind, which fail in some way to fulfil the conditions requisite to secure their acceptance as a staple commodity, but we desire to avoid saying what might be detrimental to the interests of any, and our regret would be extreme if our remarks in any way tended to the damping of commercial enterprise, especially should they result in the prevention of the successful introduction of one wood with only half the attributes characteristic of mahogany. We therefore prefer to speak in a general sense to guide those who, whilst lacking any great expert knowledge of the various furniture woods available in this market, are in actual contact at some point of the globe with timber peculiar to the district.

At the outset, it may be permissible to say—that the mere fact that a tree attains to this or that size, does not prove that it contains good timber; were this so, horse chestnut, Sapeli wood, and jarrah, by their size alone, would at once become recognised furniture woods. We are further free to admit that many foreign woods may, at their point of growth, have a local value, either by the cheapness, or the absence of any competitive woods, and possibly they may serve the primitive requirements of the district, but the same wood shipped to this country, with all the incidental charges arising from transport, would not enter into competition with those already recognised. We are not sure that Mr. Weale's suggestion as to a representative collection of samples would solve the problem, for to judge woods in a

glass case would be like attempting to decide the merits of a stuffed bird as to its qualities as a food.

As to naming of timber and its proper classification, it is not so simple as Mr. Weale appears to think, and whilst we admit that the confusion in the nomenclature is puzzling to a degree, we fail to see a remedy.

The work of our international classification of timber is beyond the grasp of any committee of inspection—practical men lack the knowledge of the botanist, whilst the botanist lacks the practical experience to enable him to arrive at a decision that would be acceptable to all. Consider for one moment the part which local names play and must continue to play; even Baltic fir is known in London as "yellow," whilst on the East Coast it is redwood. Then there is the question of coined or commercial names, such as "satin walnut" for a "gum," and "hazel pine" for the sapwood of "gumwood," and "bay poplar" for a species of "tupelo," and so we might multiply the list, but we have shown that a simple classification of timber is impossible. If the strange woods are to find a market, it will not be by the aid of museums, but they must be put on the market, bought and sold, and worked up for such purposes as they may be suitable, and experience will soon decide their utility, either for furniture woods, carriage construction, or engineering work, and if they are only good turnery wood they will find their level.

If for furniture, they must contain in a greater or less degree those virtues found in mahogany, not be of too great specific gravity, not too difficult to season, and yet possess a cohesiveness of fibre so that they do not unduly check and split, combined with beauty of colour and figure, and capable of taking a good polish.

If for carriage and wagon purposes, or for engineering work, they should possess the qualities of oak, strength and elasticity, and not be too heavy or potty. Each wood must be put in the market at prices to compete with those already recognised.

The lowness of price, combined with excellence of quality, is bound to stimulate consumption, but it must be apparent that it is not to the interest of cabinet-makers, architects, and engineers

to stipulate for unknown and untried woods, especially of those of which there is no guarantee for their continuity of supply.

We feel that at the moment there is not a good outlook for new woods, especially when we consider the present low prices of known woods—American oak planks below 2s., mahogany as low as $2\frac{1}{4}$ brokers' measure, but the world is moving rapidly, and with the revival of trade in the States and this country, we shall see an increased demand for woods of every description, so that the swing of the pendulum is bound to find room for woods which are at present despised.

Of this we are assured that every wood has its utility, and as known cuttings become depleted, or their values appreciated, so will woods, at present ignored, except at prices that are ruinous to the shippers, find in the near future an acceptable market.

Whilst it is desirable to see the area of supply enlarged, and the process of creating a demand continued, it is a pity to cut down to any extent standing timber, merely to be slaughtered.

Standing timber of every description has a value which of necessity we must appreciate, whilst felled or manufactured timber may be sold at prices that will not bring out freight and charges, and if stored, may eat itself away with interest and charges.

It should be recognised that the introduction of new woods must at the outset frequently result in loss to the shippers—especially in the present state of trade and depressed values all round; hence the greater need of discretion, coupled with a discernment to bring them forward at the crucial moment, when trade is good, and recognised woods are either scarce or dear.

In putting forward these suggestions we do not claim by any means to have exhausted the subject, and it should be noticed that it has been treated chiefly from the view of furniture woods and that of hardwoods in general, but without regard to small ornamental and turnery woods, and that no attempt has been made to trace the position and prospects of soft woods.—*Timber Trades Journal*.

ARTIFICIAL DRYING.—Wood drying by the hot air process is now practised somewhat extensively in Sweden, with the result that shipments arrive at discharging ports in much better condition

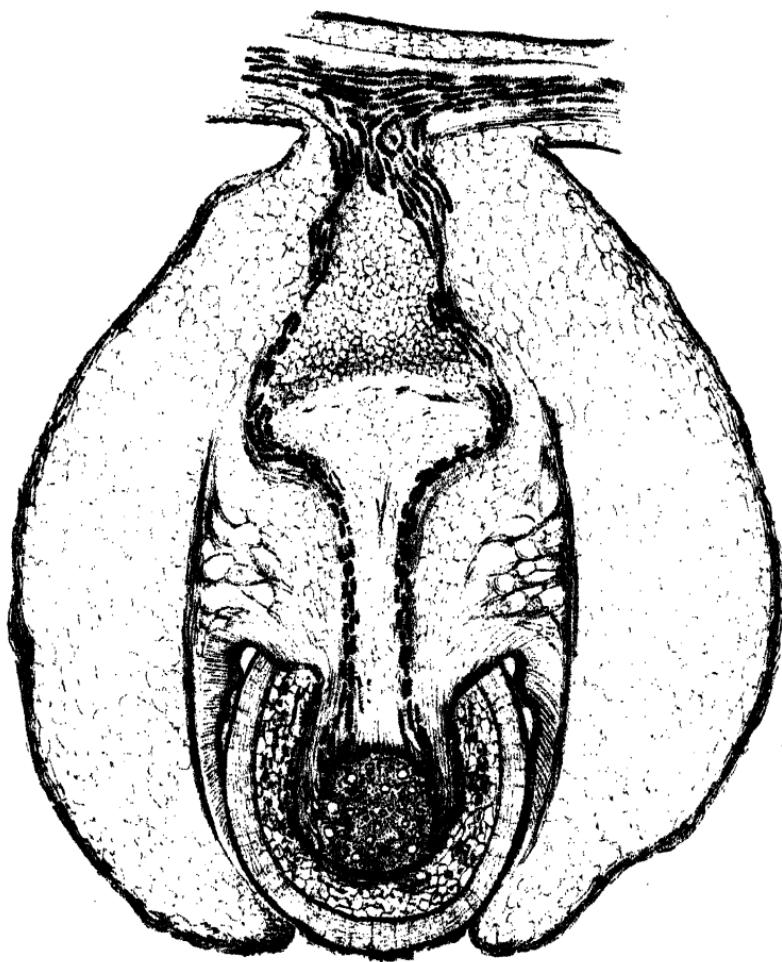
than formerly, to the satisfaction of both exporter and importer. It cannot be too strongly impressed upon shippers that allowance made for goods being out of condition seldom proves sufficient compensation to buyers, as, although the amount awarded is in many cases ample when only the strict conditions of contract are taken into account, it never makes good to a purchaser the annoyance and loss experienced in seeing his competitors move off their bright goods with facility, while his discoloured parcel is left on his hands to suffer, it may be, further deterioration. There are many exporters who fail to grasp the fact that, when once a deal or batten is thoroughly dry within, the damage done by a shower or two of rain is of no great consequence ; but if the wood retains only a small percentage of moisture, rain and damp weather will rapidly bring the fault to the surface, with disastrous results. It has been found again and again, and particularly this year, that goods which have been landed in bright condition, and apparently thoroughly seasoned, have slowly become mouldy when stored in the yards in close piles, particularly under shed in hot weather, and in places where there is no strong current of air. These annoyances are due solely to undetected moisture lurking within ; but, as far as experience goes, they might be easily obviated by the new system of artificial drying. We understand that the mills that have adopted this plan of seasoning their shipments find that the extra expense is more than balanced by the stoppage of claims on this side, to say nothing of the great gain in interest obtained through goods being ready for delivery months earlier than under the old system, and it would be interesting to the trade in general to have some statistics showing how these figures work out, particularly as to claims. It is somewhat singular that while several Scandinavian shippers were, as far as we know, the first to adopt this system, and while other exporters in Sweden and Norway are inclined to follow the example set, the Russian and Finnish exporters still stand aloof. Is their want of action owing to a disbelief in the efficacy of the process, or is it simply adherence to old-fashioned methods ? Another fact which further accounts for the better condition of Swedish goods is that covered

lighters are used much more extensively in Sweden and Norway than on the other side. The loss to many of the Russian shippers, especially at Cronstadt, through the deterioration suffered by goods owing to exposure to weather, coal dust, etc., must be very great, and should, we think, be easily obviated if energetic measures were taken to institute a better system.

ARBORICULTURE IN THE UNITED PROVINCES.—Considerable progress is being made in the extension of roadside avenues, though the heavy rains of 1903 damaged young trees in some districts. Private individuals have been encouraged to assist in planting avenues in various districts of the Agra, Rohilkhand, Allahabad, and Fyzabad divisions, and in the Fatehpur district no less than $21\frac{1}{2}$ miles of avenues were planted in this manner.

WEBSTER'S FORESTERS' DIARY.*—Webster's Foresters' Diary for the year 1905 is now ready—and judging by the splendid reception accorded to the previous issues and the many suggestions received from recent purchasers, which have been embodied in the present issue, will not only please previous subscribers, but will bring new ones, who will fully appreciate the work expended on it by the author, Mr. A. D. Webster of Regent's Park. The diary should, in the year of grace 1905, be of the greatest use to the estate agent, the home timber merchant, and the forester. The familiar dainty red-leather binding, with gilt lettering thereon, has again been adopted, whilst an inner pocket for the insertion of letters, cards, etc., and a pencil in a pocket at the back, adds to the usefulness of the book. Amongst the many items of interest to be found within its many pages (which, being of specially prepared paper, take up such a little space) will be found concise remarks on forestry for each month of the year, rules for planting, thinning and pruning, willow culture, trees for various soils and situations, timber measuring and valuing, profit and loss of barking oak, as well as a complete list of Foresters in every part of the United Kingdom—in short, everything connected with forestry and allied industries is touched upon.

* Webster's Foresters' Diary, 2s. 6d. nett. London : William Rider & Son, Ltd., 164, Aldersgate Street, E. C.



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Lith. by S. C. Mondal.

INDIAN FORESTER

APRIL, 1905.

THE AMERICAN FOREST CONGRESS.

PROBABLY one of the most remarkable gatherings ever held in connection with the study of forestry and forest problems as they affect a nation as a whole was recently held at Washington under the auspices of the American Forestry Association. Not only was the Forest Congress the largest which has ever assembled to consider questions affecting this science but it was the most striking gathering which has ever gathered together to consider an economic subject.

The purpose of the Congress is well expressed in the official summons inviting delegates :—" To establish a broader understanding of the forest in its relation to the great industries depending upon it : to advance the conservative use of forest resources for both the present and the future needs of these industries, and to stimulate and unite all efforts to perpetuate the forest as a permanent resource of the nation."

That the country was ready for such a meeting is fully borne out by the large number of delegates who answered to the call, the average attendance at the eight separate sessions being 1,000. But more important than mere numbers were the widely varied occupations of the delegates. It can be easily understood that these should include practically all those engaged directly in forest work together with the leaders in the State Forest Associations ; that persons representing the lumbering trade should attend is also conceivable ; but that influential representatives from the railroad, mining, irrigation and grazing interests should have made a point of being present shows how seriously the country has set itself to work out the forest problem presented to it, whilst at the same time emphasising the close connection which a sound forest policy has with these varied interests.

It is unnecessary to dwell upon the great interest which President Roosevelt has always evinced in the forest question, or to the great impetus which this interest has undoubtedly given it. Publicly and privately he has ever been in the van as a champion for the proper conservation of the forests in his country, and it must have been a great reward to him to receive such a truly representative gathering as the Congress presented when it assembled to meet him at the State, War and Navy Building previous to the opening of the first day's proceedings.

In addition to a special meeting, at which a notable address by President Roosevelt himself was the leading feature, the programme included half-day sessions devoted particularly to irrigation, the lumbering industry, the grazing industry, railroads in their relation to the forest, importance of forests to mining, and one devoted to national and State forest policy. The mere consideration of such questions, all having an intimate connection with the forests (although this connection has not always, in other countries, been as widely recognised by the individual departments as should be the case) is in itself a remarkable tribute to the thoroughness with which our cousins throw themselves into a matter once they have become convinced of its importance. The Congress went, however, a step further: in order to ensure each industry being correctly and indisputably voiced at each of the sessions a man prominent in the line of work under discussion acted as presiding officer, whilst the papers and addresses presented were by men of note in their particular line of work. When one looks back to the attitude of the lumber trade, *e.g.*, towards forestry but a few short years ago it is a sufficiently striking tribute to the breadth of grasp and intelligence of the nation to find lumbermen on the platform speaking in favour of forest reservation and the importance of strict conservation and working.

Mr. James Wilson, Secretary for the Department of Agriculture, presided over the meeting, and in his opening address placed the matter on a broad and national basis as follows:—

"We are beginning a meeting which is national in its significance. Never before in this country, nor as far as I know, in any

other country, has a body of men representing such great and varied interests come together to discuss temperately and foresightedly the policy and the methods under which the highest permanent usefulness of the forest can be maintained. That we, men as varied in our occupations as are the industries and interests we represent, are drawn together by this common cause, may well mark the beginning of a new era in our treatment of the forest. Your presence here is itself the best possible proof that forestry is rapidly taking its appropriate place as an active and indispensable factor in the national economy. The era of forest agitation alone has entirely passed. We are talking less and doing more. The forest problem, as President Roosevelt has described it, is recognised as the most vital internal problem in the United States, and we are at work upon it."

Our space will not permit of our dwelling here upon the papers read upon purely forestry subjects, although note may be taken of the fact that Mr. Aubrey White, Commissioner of Crown lands in Canada, described the forest resources of Canada and the manner in which his Government were looking after their preservation. It is our purpose, however, to draw attention to the remarkable set of papers presented by what may be termed the departments allied to forestry.

The session on the afternoon of the second day was devoted particularly to the importance of the public forest lands to irrigation. The head of the United States Irrigation Service, Mr. F. H. Newell, was in the chair, and the first paper read was delivered by Mr. Guy E. Mitchell, Secretary of the National Irrigation Association, on the "Close Relation between Forestry and Irrigation." Mr. Newell then called upon United States Senator Clark to preside and himself read a paper on "Forests and Reservoirs," outlining in a clear fashion the immense part that is being played by the forests in the reclamation work of which he was the Chief. This important paper was succeeded by one on "The Relation of Forests to Stream Flow" by Mr. J. B. Lippincott, Supervising Engineer of the Irrigation Service, and "Irrigation Construction and Timber Supplies" by Mr. A. P. Davis, Assistant Chief

Engineer of the Service. Two short impromptu addresses on the importance of this subject were also delivered by Mr. H. M. Wilson of the United States Geological Survey and Professor Toumey of the Yale Forest School. We have not space here to touch upon the matter contained in these papers; their titles moreover speak for themselves, and we would suggest that they might be perused with interest in India. They indicate plainly that the Americans, both in and out of the departments concerned, have fully grasped the importance of the principle that the Irrigation and Forest Departments should recognise that whilst the very nature of their work entails their being separate bodies yet the results aimed at by the one require that its members should thoroughly understand the work and mission in the country of the other in all the aspects in which this latter bears on their own duties.

In the session devoted to the Lumbering Industry Mr. N. W. McLeod, President of the National Lumber Manufacturers' Association, was in the chair, and delivered an opening address, which was followed by papers on the "Changed Attitude of Lumbermen on Forestry," "The Importance of Forestry to the Woodworking Industry," "The Lumber Dealers' Interest in Forest Preservation," &c. These papers show in a remarkable manner the great change with which the industry has come to regard forest conservancy.

The Grazing session was presided over by the President of the National Live Stock Association. Mr. A. F. Potter, Grazing Expert of the Bureau of Forestry, delivered an address on "Practical Results of Grazing on the Forest Reserves," illustrating it by examples and explaining clearly the detrimental effect of grazing on steep hill slopes, in forests full of young seedlings, &c. An interesting paper took for subject "Sheep Grazing in the Reserve: from a Layman's Standpoint," by Professor L. H. Pammal, of the Iowa State College. The discussions which followed treated the subject from an exceedingly broad-minded and impartial standpoint, and should prove of considerable interest to those concerned with such questions in India.

With Mr. Howard Elliott, President of the North Pacific Railroad, in the chair, the first session of the third day's proceedings was opened. General Charles Manderson, General Solicitor of the Chicago, Burlington and Quincy Railroad, was the first speaker, and took for his topic "What Information is most urgently needed by Railroads regarding Timber Resources." The following paper, by Mr. I. T. Richards, Chief Engineer, Pennsylvania Railway, on "The Work of the Pennsylvanian Railroad in planting Timber for cross ties (sleepers)," was particularly appropriate since the Bureau of Forestry has initiated widely-exploited experiments in treating sleepers. Dr. Hermann von Schenk's paper on "The Results of the Preservative Treatment of Railway Timber to prolong durability" was also of great interest as he is the officer in charge of the timber-testing plant of the Bureau of Forestry.

The special session held in the afternoon of this day took place in the National Theatre, where President Roosevelt delivered an address on "The Forest in the Life of a Nation" to an audience of 2,000 people. This address made a deep impression, and is certain to have considerable influence since it has been published throughout the country.

Dr. David T. Day, of the United States Geological Survey, took the chair at the mining session, the papers being confined to the subject of Forestry and Mining. Mr. A. L. Fellows, Consulting Engineer, United States Irrigation Service, delivered the opening address on the subject of "The Development of Water Power as related to Forest Reserves," and this was followed by an address by Dr. Day, additional papers being read upon "How the Forest Reserves help mining" and "Mining in the Forest Reserves." A closing address, which excited much enthusiasm, was given by Mr. G. H. Maxwell on the "Value of Forestry to Commercial Interests," in which the author clearly showed how generally the business interests are dependent on the forests of the country.

From the above short notice of the proceedings of this Congress it will, we think, be conceded that the subject was not considered from a one-sided point of view, and it would be impossible to underrate the importance of the result attained; the practically

unanimous concensus of opinion in favour of the value of forests to a country of a body of men—experts in their own lines and looking upon the problem each from his own peculiar and particular point of view.

The verdict arrived at may be looked upon as that of the country at large since the delegates to all intents and purposes represented a plebiscite of the people.

It is perhaps but natural that the thought should arise: Have we anything to learn from this Congress? Can we, by a careful consideration of its conclusions, the conclusions of the finest intellect in the United States, so apply them to the very different conditions we have in India that we may bring home to the minds of the people of the country a fuller and clearer knowledge of the true reasons which render forest conservancy, not merely the broad-minded policy of a great statesman, not merely an aid towards supplementing the revenue returns, not entirely the hobby of a prejudiced class of professionally-trained men, whose object appears to be the harassment of the people, but an absolute necessity both for the country and its inhabitants and in the true interests of their posterity. Such an object is no mere ideal, and it will come within measurable distance of realisation when the various sister Services in India, whose work leads them into contact with the forests of the country, endeavour to make themselves acquainted with the forestry problem as it affects, or is affected by, their own particular work and the people who are dependent on the results of that work. We should most gladly welcome from men in the Indian Services such a remarkable series of papers as have recently been read at Washington; and we are of opinion that there are few who would question their economic utility.

SCIENTIFIC PAPERS.

THE HAUSTORIA OF SANDAL ROOTS.

BY C. A. BARBER, M.A., F.L.S.

The study of the relations between parasites and their hosts is always interesting. We are well accustomed to the presence of animals permanently fixed to others, but that plants should obtain their nutriment by sucking the juices of other plants comes at first as a matter of surprise to the students of the vegetable kingdom. The true nature of such parasitism was not understood until comparatively recent times. For many years it was largely held that fungous outgrowths were a sort of malformation of the plant tissues, and were classed as a kind of disease similar to the galls caused by insects and the tumours of the human body. And although the fact was soon ascertained that there was organic connection between higher plants as well as fungi, it was assumed that the phenomenon was of this tumour nature, and attempts were even made to explain why so great a change in flowers, leaves and fruits should have been brought about.

With our present knowledge of the ravages of fungi upon the tissues of the higher plants, it is not easy to understand the difficulties which offered themselves to early students of plant parasites. The best work of many brilliant Botanists has been devoted to the subject, and we have now a fairly comprehensive knowledge of the manner in which the fluids pass from host to parasite. But the fact that, besides fungi, highly organised green flowering plants, such as the sandal, obtain their nutriment by this irregular means still remains one of the wonders of the vegetable kingdom. It is to this study that I wish to direct attention, especially as all the facts have by no means been elucidated.

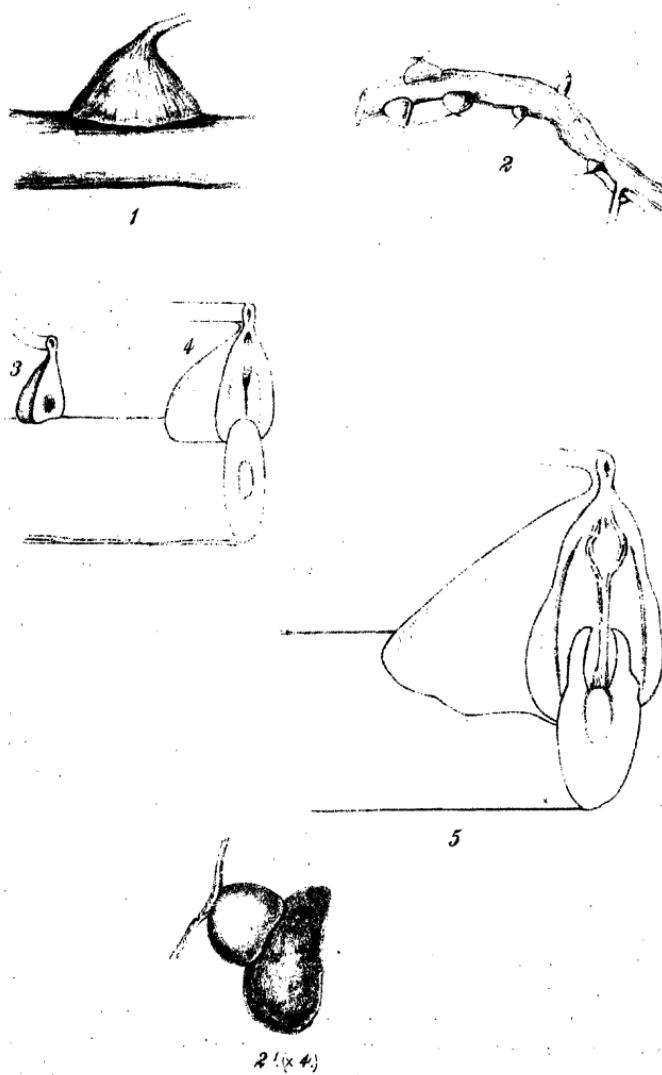
Of phanerogamic parasites there are a large number in India ranging from semi-parasitic crop weeds, such as *Striga*, differing little from the ordinary flowering plants, to such forms as *Orobanche*,

without chlorophyll and with brown scale-like leaves, and the still more mysterious *Balanophoras* of the ghaut forests, whose only resemblance to the higher plants is seen in their spikes of brightly coloured little flowers.

These parasites may be roughly divided into two main classes, according as they attack parts above or below the ground. Of the former, the Indian mistletoes, *Viscum* or the more numerous species of *Loranthus*, the common thread-like *Cassytha* of our dry forests and the various forms of dodder or *Cuscuta*, may serve as familiar examples. They are aerial in their growth, and fasten themselves on the stems of their hosts. Of the other class, the root parasites, the sandal is perhaps the most highly organised, forming as it does a luxuriant and handsome tree, laden with masses of green leaves, flowers and fruits.

It would seem that until recently those who had to do with sandal plantations were uncertain as to its parasitic nature. But it is now beginning to be a matter of some doubt whether the sandal takes its root-nourishment in any other way than by sucking the juices from adjacent plants.

Although the organs of attachment, or "haustoria" as they are called, will adhere to the most unlikely substances, yet in sandal, as in other root-parasites, there would appear to be a certain amount of selection exercised as to its hosts. We have thus been led to speak of such plants as *Tecoma Stans*, *Cassia siamea*, *Casuarina equisetifolia*, *Pterospermum Heyneanum* and *Lantana Camara* as good "nurses," thereby meaning that the sandal grows readily in the company of these plants. This is no new fact, and the most various explanations of it have from time to time been offered. Shade, aspect, the formation of humus, and so on, have been brought forward as dominant factors in the association of sandal with these plants, and it is curious that it did not occur to those interested to study the root system more carefully and to test the sandal's so-called "doubtful parasitism." From pot experiments and from examination in the field it appears that the sandal attaches itself with avidity to the roots of the good nurses referred to, and it is therefore justifiable to assume



that this underground affinity is of more importance than any questions of shade, aspect or locality. Within certain limits, the condition suitable for the best nurses will be those most likely to produce the most healthy and rapidly growing sandal trees. The effect of neighbouring plants on the quality and quantity of oil in the heartwood would form an interesting study for those Forest Officers who have the advantage of living in sandal-bearing tracts. It is quite probable that, given the most healthy conditions and the proper climate, those nurses will be most useful as oil producers which feed the plants most generously.

I propose, in the present note, as a contribution to our knowledge of sandal, to give a short description of the haustoria. It does not appear that such an account exists, although the allied little *Thesium*, from its occurrence in European regions, has been fully described by more than one observer. The ease or difficulty experienced by the sandal in its attacks on various roots may form the subject of a later communication, but, to avoid excess of detail, which would be out of place in a practical journal, I shall content myself for the present with referring to a perfectly straightforward, simple case in which the attack is easily and successfully carried out.

I have shown in a previous note that the haustorium arises independently of the presence or even nearness of surrounding rootlets. It is probable that in case no host is met with, a comparatively rare occurrence in nature, the haustorium remains small and ultimately withers away; but if a foreign rootlet is met with, it grows rapidly, and develops into a mass of white tissue, at first club-shaped, but later on adapting itself to and enfolding the surface of the root attacked, and taking on more or less the form of a flattened bell, figs. 1 and 2.

The haustorium applies itself closely to the surface of the root. It becomes enlarged at the point of contact, increasing in the direction of the root's length, and thus becomes elongated and concave with an oval outline. While the haustorium, at its origin from the parent root, frequently many times smaller than itself, remains narrow, it increases in diameter as it nears the

point of application, and thus its conical or bell-like form is assumed. These points are illustrated by the accompanying drawings and diagrams, figs. 3—5.

It is usual, when studying the tissues of the haustorium affixed to a root, to pay special attention to the section passing through the length of the haustorium and at the same time cutting the attacked root across, for in this section most of the tissues concerned are brought into view at the same time. But, thoroughly to understand the matter, it will be necessary to study the arrangement in at least three different planes. These are as follows :—

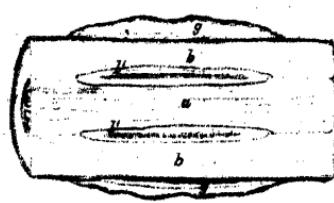
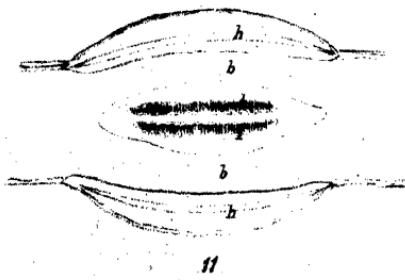
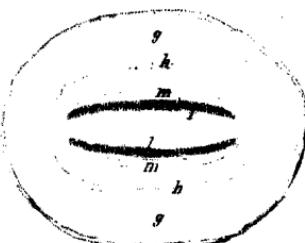
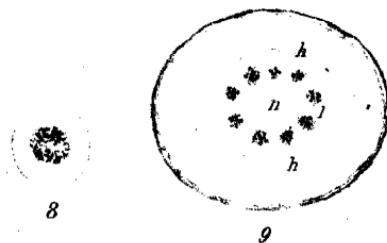
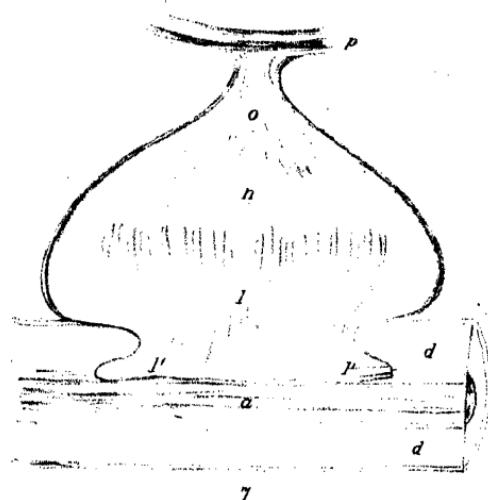
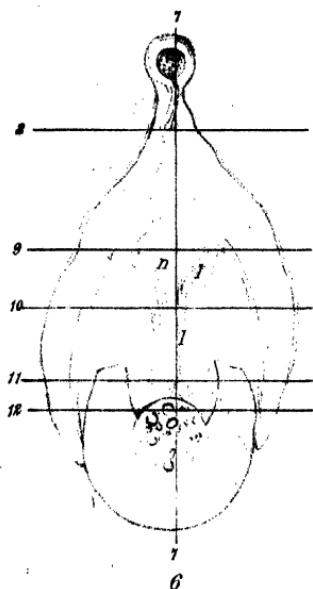
(1) *Transverse section*, cutting across the root attacked and therefore through the haustorium from its point of origin to its point of attachment, fig. 6.

(2) *Longitudinal section*, cutting lengthwise both the haustorium and the root attacked, fig. 7.

(3) *Tangential section*, cutting the haustorium transversely and the attacked root tangentially or parallel with its long axis. Figs. 8—12 show tangential sections at different levels, and their positions are indicated by the cross lines in fig. 6.

It will be seen that the name given to the section depends upon the direction in which the attacked root is cut, and this is natural, because this organ gives the haustorium its characteristic shape and regulates the internal distribution of its tissues. It will also be understood that the character of the tissue elements, as well as their arrangement, can only be determined by examining all of these sections, and to make matters clear the outlines referred to above may be consulted and compared.

The transverse section is the most important, for the reason already mentioned, and this will be studied in detail. The outline of such a section will vary much according to the relative size of the haustorium and the root of the host, to the age of the haustorium and the species of the plant attacked, and, finally, according to the ease or difficulty experienced by the parasite in its attempts at penetration. In perhaps the most usual case the root attacked is small and the haustorium spreads itself out



after contact until it considerably exceeds it in breadth. Transverse sections will then remind one of the saddle on a horse's back, but to the saddle is fixed a "pack" or bundle of considerable dimensions, and the saddle is secured, not by the usual girth round the animal's body, but by a process penetrating its back, cf. figs. 4, 5, 6 and 13.

The tissues exposed in the transverse section are of great variety, showing an organ of some complexity. Taken as a whole, those of the haustorium are white and succulent, while those of the root are hardened, brown and more or less decomposed. Three main regions may be distinguished in a well-cut section :—

- (1) that of the root attacked, fig. 14, *a—e*;
- (2) that of the haustorium, *f—o*;
- (3) that of the mother root *p*, the latter not always included if the section is not strictly median, and varying also with the direction in which the mother root is passing, cf. figs. 6 and 13.

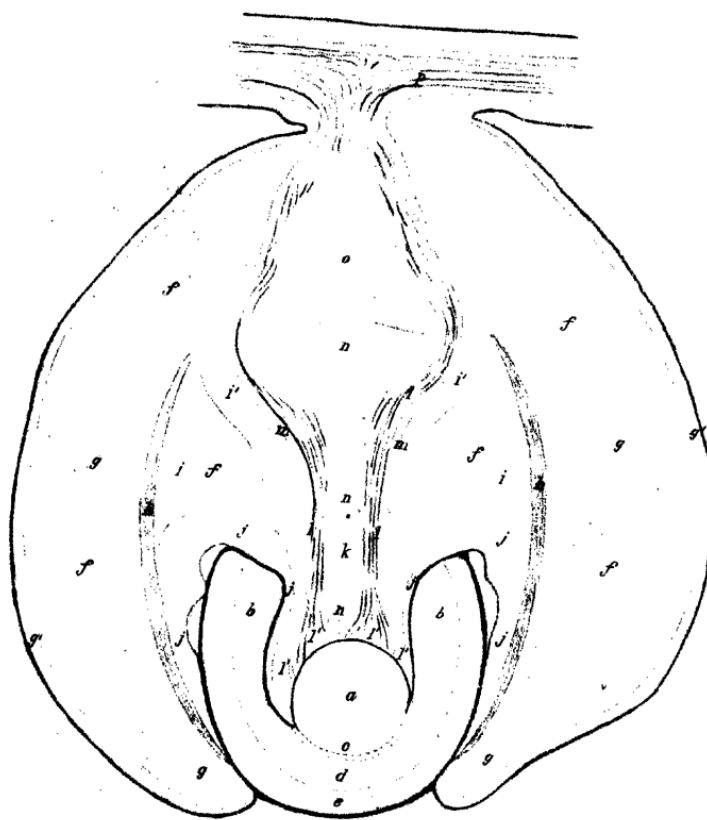
The drawing with its explanatory diagram (figs. 13 and 14) is taken from a sandal root grown in a pot with *Pterospermum Heyneanum*. The root of the host is seen to be split as far as the cambium layer *c*, while the two cortical "wings" *b* are thrust apart on either side to make room for the penetrating process *k*. The woody cylinder *a* is composed of thickened elements, and has thus been able to resist further intrusion, but it is not always so. When the medullary rays are large and the sclerotic cells of the wood alternate with thin-walled parenchyma as in *Opuntia Dillenii*, the penetrating process may proceed to the pith and even beyond it, rupturing the woody cylinder irregularly. In *Thespesia populnea* the vascular cylinder is sometimes split completely in two, and so on. The present case may be taken as typical of dicotyledonous roots with a vascular cylinder of some density. When the haustorial cells reach the cambium, they follow it to either side, and, in the case under examination, spread out until they embrace more than half the fibro-vascular cylinder. As will be seen later, it is the aim of the intruding sucker to bring its absorbent cells into close contact with the conducting

elements of the host's root, namely, the younger woody tissues. No further growth takes place in the attacked root in the place where the cambium has been invaded, the cells of this layer having been completely destroyed, but the formation of wood and bast proceeds for some time in the uninjured portion.

The alterations caused by the parasite in the tissues of invaded roots form an interesting study, which for the present must be passed over. Suffice it to say that the roots attacked are by no means passive, and, although usually ineffectively, show their disapproval in a variety of ways differing according to the species. Layers of cork, thickening of the cell-wall, the formation of thyloses and the extrusion of gum (?) are commonly met with, while the occasional cases where a sandal root becomes attached to itself show a distinct attempt on the part of the root attacked to form new tissues and occlude or grow round the haustorium.

The haustorial tissues have been divided in *Thesium* into two portions, the outer clasping "cortex" and the inner, penetrating "nucleus," divisions which may for the present be adopted.

The cortex is formed first and consists, in the mature haustorium, of non-absorbing cells which have lost their activity and have become what is called "permanent" tissue. These cells, now that penetration has been effected, have ceased to grow or divide, are fast losing their protoplasm and have become a protective layer for the younger cells of the nucleus within. But the different parts of the cortex do not cease their growth all at the same time, and the pressures and tensions exerted on the one hand by the increasing inner cortex on the quiescent outer, and on the other hand by the growing nucleus on both, have given rise to the somewhat characteristic and peculiar features now to be noted. The most striking character of the cortex is the presence of two bands of tissue *h* symmetrically placed on either side, and extending from the upper portion near the mother root down to the edges of the flaps of the "saddle." These bands, on examination, are seen to be homogeneous and



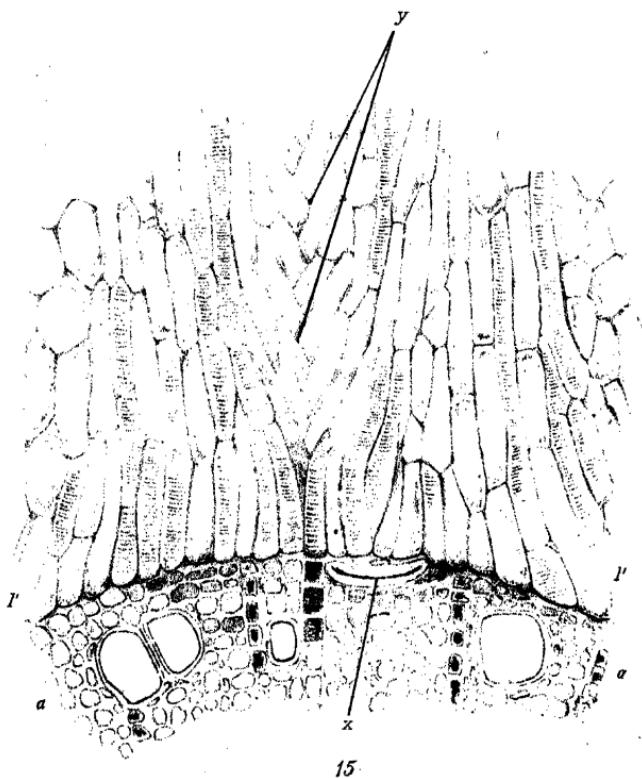
highly refractive, are very sharply marked, but without definite cell cavities. A careful study of their formation shows that they consist of the compressed walls of a number of collapsed cells. From their marked character and constant presence in all haustoria, they have been utilised to divide the cortex into an outer and an inner portion, and have been called a "separation layer." The origin of these collapsed layers, as I prefer to call them, does not seem to have been very clearly explained in the literature at my disposal (they occur also in *Thesium*); but, from a study of early stages of development, there is little doubt that they indicate lines of pressure between actively growing, turgid cells and such as have lost their turgidity and are becoming permanent. The increase in diameter of the developing nucleus and the still turgid cells of the inner cortex have exerted such pressure upon the dying cells outside, which are incapable of expansion, that the latter are crushed flat at the point of contact. That this is the correct view is supported by studying the subsidiary collapsed layers which occur in the section. These are almost always found round the borders of the cells outside *j*, between *k* and *o* and outside *i'* on either side. At *i*, on the other hand, considerable tension is exerted by the rapid growth in length of the nucleus when actual penetration is being effected, cf. figs. 4 and 5. The tissues in this region are therefore not only collapsed, but also torn asunder so as to form a series of lacunæ. All these layers are formed at different periods of growth, but, generally speaking, the internal tissues retain their turgidity longer than the outer earlier formed ones. Thus those of the outer cortex die first, those of the inner cortex *i* next, while the other portions of the inner cortex *i'* and *j* are transformed into permanent tissue only after penetration is effected and absorption is taking place. It may be further stated generally that when the junction between the tracheides of the haustorium and the vessels of the host is effected, all the parenchymatous tissues gradually lose their protoplasm and become clear, so that it is possible by observing their character to determine the age of the attachment.

Having thus cleared the ground by the study of the collapsed layers, whose presence in the section is a constant source of wonder and confusion; we can proceed rapidly to refer to the different tissues separated by them from one another.

The cells at *g'* are crushed outer cortical cells. They take the place of cork and afford an outer protecting layer to the organ. Periderm is not usually formed, but has been detected in certain cases, *e.g.*, *Pithecolobium dulce*. The cells of *f*, *g*, *h*, *i* have been already referred to. The tissues at *l'* remain active for a longer period than the rest. That at *j* surrounds the two cortical wings of the root of the host on all sides. The cells are arranged side by side ~~at~~ right angles to the surface of the wings, and have probably been absorbent or capable of absorption in earlier life.

In the nucleus, *k—n*, the cells at *n* have become permanent with or without a collapsed layer down the middle. They do not appear to take any part in absorption, and definitely terminate at some distance from the woody cylinder of the host. These cells are much elongated in the lower part of the nucleus, but in the upper, expanded portions are more or less isodiametrical parenchyma. They are sharply marked off these by a collapsed layer from the cells of *o*.

The effective portion of the nucleus may be divided into two parts, an upper, conducting and a lower absorptive. The two vascular strands *l*, composed of tracheides, are early set apart as conducting tissue, to transfer the stream of water and salts from the host to the mother root. A glance at these strands shows that they are parallel for the greater part of their length, but that they widen out at both ends. The widening at the lower end is trifling in the figure, but is sometimes very noticeable. It depends on the diameter of the woody cylinder of the host. The widening at the upper end is sudden and constant, and is less easy to explain. A study of the tangential sections through different heights of the nucleus will furnish a possible solution of figs. 9 and 10. It is seen there that the number of tracheides in the nucleus are about the same in quantity at these two levels. In the lower part, which is drawn out in the direction



15

of the host's root, the tracheides are arranged in two parallel bands. In the upper part, which is much narrower, the tracheides are arranged in a circle or nearly so. The widening seen in the transverse section is necessary to accommodate the whole series of tracheides so that continuity shall not be broken in the passage of the fluids. The suddenness of the expansion is not explained, and it is more probably due to the fact that the lower portion of the nucleus alone takes part in the rapid elongation, when penetration takes place, while the upper expanded portion is enabled to increase in the ordinary, radial direction.

Outside these tracheides, on both sides, there are certain thin-walled cambiform cells *m*. Fortunate sections show that these cells have arisen from the same mother cells as the outer tracheides, and their position indicates that they form a short-lived cambium by which new tracheides can be added to the vascular strands when needed. There is no appearance of sieve-tubes in the sections examined. A much smaller band of meristematic tissue is seen on the inner side of each strand in some sections, but it does not appear to be of the nature of cambium and has no apparent relation to the adjoining tracheides.

The absorbing portion of the nucleus is seen at *l'* and in fig. 15. All the cells of the nucleus in contact with the woody cylinder of the host take part in this work, and direct connection is readily traceable under the microscope between the elements belonging to the two roots. In one sense this is the most important and interesting part of the haustorium.

The absorptive cells consist of tracheides and elongated parenchyma between them. The tracheides sometimes communicate directly with the vessels of the host, but are generally content to apply themselves to the wood parenchyma. The parenchymatous absorbent cells apply themselves to all the parts not occupied by the tracheides. Here the real transference of nutriment from the host to the sandal takes place, and the whole apparatus is designed both to protect this vital part from harm and to expose to the action of the haustorial cells as large a surface as possible of the conducting cells of the host.

The action and arrangement of the tracheides differs according to the species of root attacked. In some, as *Jatropha curcas* and *Coleus sp.*, where the vessels of the vascular cylinder occur in well-separated radial rows, they appear to be only applied to the ends of these rows of vessels.

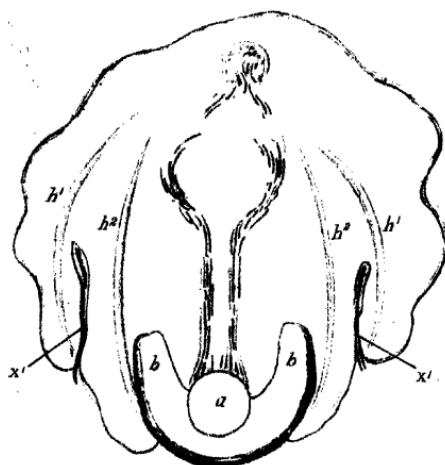
But in the majority of cases examined they are in contact with all the elements of the wood alike. Usually in intimate contact, the cells and tracheides of the haustorium are sharply separated off by cell walls from the elements of the root attacked. In some, however, as *Gyrocarpus jacquini*, the tracheides actually appear to penetrate the vessels after the nature of thyloses.

The cells of the haustorium differ a good deal as to the nature of their contents. Those of the nucleus are, taken generally, filled with granules and protoplasm (with the exception of course of the area of tracheides), and this gradually disappears as the cells increase in age. The cells of the cortex in a similar manner are full of starch, which becomes disintegrated and finally disappears as the cells become permanent tissue. It is probable that this store of starch is used up during the actual penetration, which takes place at a rapid rate.

As a consequence of this difference in contents, the nucleus is yellowish and turgid in sections from spirit material, whereas the cortex is white and clear.

So much for the transverse section. Reference should be made to the tangential and longitudinal sections, figs. 6—12, whose lettering is the same as for that in fig. 14.

The tissues of the haustorium having been passed under review, it remains to consider the manner in which an entrance is effected into the root of the host. The means adopted are three-fold:—(1) The cells of the surface of the haustorium have the power of *dissolving the walls* of the root cells opposed to them; (2) *Pressure* is more rarely exerted, but is evidenced by the compressed cells of the haustorium before entrance has been effected and the occasional collapsed vessels in the roots attacked, *cf. x* in fig. 15; (3) In large haustoria a well defined *secreting gland* is present.



The substance secreted, having the power of dissolving cell walls, is probably some *cyto-hydrolytic ferment*, and the translocation of starch grains points to the presence of a *diastatic ferment* as well. Both the epithelial cells of the gland and the epidermal cells when they are in contact with the tissues of the host show large nuclei and abundant granular protoplasm such as is met with in secreting cells.

The outer, cortical flaps of the haustorium are usually single, as drawn in the figure. Cases are not infrequent however where two flaps are present on each side one over the other, fig. 16. When this is the case we may speak of "double haustoria." The second flap k^2 arises from a great development of cells in the inner cortex on each side, and appears to be due to failure on the part of the haustorium from some cause in effecting an entrance. As far as can be gathered from the cases examined partial entrance has been made, but the lobes of the haustorium have diverged before reaching the cambium. Thus a small piece of dead bark is always to be seen at x^1 . When once the cambial layer is reached a second, inner flap is not formed. Each flap formed has a well defined collapsed layer exactly similar to that in the first one. In one case met with four such superposed caps were noted.

In conclusion it may be noted that the haustoria vary a good deal in their complexity, according to the substance to which they are attached. The gland does not seem to be always present. It is of course only needed in young haustoria, but its former existence can be readily detected in older stages, cf. y , fig. 15. This points to a greater simplicity of the whole organ, and is chiefly met with where the root attacked is small or when the haustorium is attached to small bits of decaying leaves or bark, or the nitrogenous tubercles of *Leguminosæ*. In such cases even the tracheides are inconspicuous or absent, and the collapsed layers may even be wanting. In the haustorium mentioned above which had attacked a small chrysalis, a double cortex was present, but the whole structure was extremely simple. A great mass of parenchyma was pushed into the cavity of the chrysalis, the epidermal cells of which had grown out in the manner of root-hairs.

The curious fact has been noted that the haustoria may become attached to inorganic objects such as pebbles. A number of these have been examined, and they show a series of different stages of development, short of the penetration and the formation of the tracheides. The epidermal cells, or rather those immediately beneath them, show a constant tendency to grow out after the manner of root-hairs, and insert themselves into the depressions of the surface of the pebble. In one pot examined by far the largest haustorium was fixed so firmly to a big pebble that it could be swung about without becoming detached, and a well developed gland was present, cf. fig. 2.¹

The numerous unattached haustoria of the sandal were thought by Scott, their discoverer in 1871, to indicate that the sandal is much less parasitic than it was formerly. But it seems to me to be quite as reasonable to deduce a developing parasitism from the clumsy and futile attempts just described, and I propose to carry this study further as time permits.

MADRAS :

29th December 1904.

Explanation of the figures.

- (1) A large haustorium of *Santalum album* on a *Casuarina* root.
- (2) A piece of *Casuarina* root much attacked by haustoria.
- (2¹) A haustorium firmly fixed to a pebble. Magnified four diameters.
- (3) (4) Young haustoria cut open to show the parts before penetration. In (4) there is a gland forming at g.
- (5) A mature haustorium open cut showing penetration.
- (6) - (12) Studies of sections of haustoria in different planes under simple lens magnification. The letters refer to the parts shown in figs. (13) and (14).
- 6) *Transverse section*, the haustorium cut lengthwise and the attacked root across. The numbers 7—12 indicate the planes in which the succeeding sections are cut.
- (7) *Longitudinal section*, both haustorium and root cut lengthwise.
- (8)—(12) *Tangential sections*, at different levels, of fig. (6). The parts will be best understood on comparing the letters with those in figs. (13) and (14).
- (13) A transverse section through a haustorium on a root of *Pterospermum Heyneanum*, magnified about 40 diameters.
- (14) An outline key to fig. (13).
- a—e, the root attacked, f—the haustorium proper, o the region of transition from haustorium to mother root, p the mother root.

The root attacked, *a* vascular cylinder, *bb* cortical wings thrust aside by the penetrating process or *sucker* of the haustorium, *c* cambium, *d* cortex, *e* bark, chiefly cork.

The haustorium may be divided into *cortex f—j*, and *nucleus k—n*. In the cortex, *g* outer cortex, *g¹* squashed outer protecting layer, *hh* collapsed layers separating the outer cortex from the inner, *i* lacunar tissue of inner cortex, *i¹* starch-filled parenchyma, *j* epithelial layer enfolding the "wings" of the attacked root.

In the nucleus, *l* the two strands of tracheides, *ll* the absorbent portion of the haustorium directly in contact with the vascular cylinder of the host, *m* the short-lived cambium, *n* the inner part of the nucleus.

(15) A small portion of a haustorium on a root of *Casuarina equisetifolia* showing the actual contact of the absorbing cells and the vascular cylinder of the host. The part illustrated is that between the two inner *ll* of fig. (14) and is magnified between 400 and 500 diameters.

a woody tissues with vessels, wood parenchyma ? and medullary rays. A collapsed vessel is seen at *x* and the dark boundary line represents the position of the decomposed cambium. *ll* the absorbent cells, parenchyma with granular protoplasm and tracheides. At *y* in the centre the remains of the gland are seen. See also fig. (4) for a young stage of the gland.

(16) A "double haustorium" attacking a sandal root. *h'h'* the collapsed layers of the first formed cortical flaps, *h¹h²* the collapsed layers afterwards formed from the inner cortex, *x'x'* pieces of bark showing the depth to which the first penetration took place, just as *bb* shows the second and more successful attempt.

* NOTE.—For much of the material used in the preparation of this paper I am indebted to Ry. Rama Rao, of the Madras Forest Department, who has the advantage of residing in a sandal tract.

ORIGINAL ARTICLES.

A WORKING PLANS BRANCH.

BY G. S. HART, I.F.S.

As must have been the case with all the recipients of the January number of the *Indian Forester*; I was very pleased to see the great improvement that has been effected in the garb of the Magazine, and I think that the Committee of Management are also to be warmly congratulated on the fact that the *Forester* has signalled its appearance in its new form with the important article on the formation of an Indian Bureau of Forestry.

The views expressed in that article that much of the sylvicultural, commercial and scientific work which should have been done has had to be neglected owing to the fact that the time and energy of the present staff are fully occupied with their executive duties, are not open to argument. Still there can be equally no doubt that much valuable work of this kind has been done, only there has been no organisation for collecting it and circulating it in a useful form, so that it has remained of very little advantage except to the compilers themselves. It is here, I think, that the Department is to blame, for probably one of the main reasons that we have no organisation of this description is that we have never taken the trouble to ask for it with sufficient insistence. However, it is never too late to mend, and for this reason I look upon the article under reference as one of the most important that has appeared in the *Indian Forester* for some time past, and I am writing these few lines in the hope that the Department generally will take up this question and show that, as a whole, they are fully sensible of the great advantages such a Bureau will give them.

For the present I propose to confine my remarks to the subject of working plans, of which I have had some little experience. Of the other subjects one is already provided for, and though I would not for one moment belittle the great importance, indeed the necessity, of organised investigation into the subjects of Forest Botany and Minor Products, or the beneficial results, financial and otherwise, that must attend such investigation, still I think that working plans are the most important branch of our work and the one of which the management under present conditions calls most urgently for revision. The future of the forest estates committed to our control depends on the plans we make for them ; but how are these plans made now ? In one of the largest circles in India most, if not all, of the plans turned out during the last twelve years have been compiled by the Divisional Officers with such assistance as could be given to them in the shape of the last joined recruit from Home, or a junior extra Assistant Conservator, or a Forest Ranger taken off his ordinary work, and this too mostly changing from time to time

during the compilation of the plan. Obviously really good work cannot be done under these conditions. A working plan requires the whole time and attention of the officer responsible for its production : it is not the kind of work that can be done in sections at such times as the exigencies of Divisional work permit, nor is it the kind of work on which an officer can be usefully employed, either directly in charge or as an Assistant to compile the plan under the general supervision of the Divisioned Officer, until he has had five or six years' practical experience of forest work in this country to back up the theoretical knowledge acquired during his Home training. Our sample plan, however, is completed in this way and then goes to the Conservator for scrutiny. It may be held that this should be quite sufficient, and that the addition of the Conservator's advice and assistance during the preparation of the plan should be all that is necessary to ensure its suitability. The Conservator, however, may have several plans in progress at the same time, and it may be quite impossible for him to give to each the attention it requires, or he may be new to the circle, in which case he is obliged to devote all his time to making himself acquainted with the general conditions of his charge and to getting a working knowledge of the Divisions, or perhaps he may be of opinion that there are other more important matters requiring his attention, so that it is at least possible that the Conservator's share in the plan may not be all that could be desired. Finally, our plan is countersigned by various Civil Officers, put into print and despatched to the office of the Inspector-General of Forests, where it may be passed or rejected. In the former case it goes on to the Local Government and is sanctioned, while in the latter it returns to its unfortunate compiler or his still more unfortunate successor for correction. Even, however, when finally sanctioned by the Local Government it is by no means quite certain that its provisions will be strictly adhered to for very long, for under section 88 of the Forest Code the Conservator, in conjunction with the Local Government, can do a good deal in the way of modification, so long as his action does not amount to "a revision of the general scheme of management," a somewhat elastic definition.

But the question is, how? The average rainfall in the district is something under 20 inches annually, all of which falls between the second week of June and about the middle or end of October, with the exception of a few heavy showers in May. For about seven months in the year, then, there is no rain at all and struggling vegetation has to endure intense heat from the end of February to June. If planting is undertaken, the young plants must be watered for these months in their first year and at least for the hot months in their second year if they are to survive, which makes the cost of the undertaking almost prohibitive even on level ground where wells can be sunk and watercarts employed. On hilly ground planting would be impracticable. If seed is sown naturally or artificially the young seedlings cannot survive the hot weather and die off. At best the root system remains alive, and they spring up again the next rainy season, but I believe that as a rule it takes at least six years, and possibly as much as ten, before the root system is strong enough and deep enough for the plant really to begin to grow.

I believe that the solution of the difficulty can be found in the method that ryots employ in the Adoni Range for making Neem (*Melia azadirachta*) hedges for their fields—a method that I have never seen employed elsewhere. It is to make ridges two feet high and sow the Neem seed on the top. No trench is dug, but the ridge is made by simply scraping up the surface soil. The sowing takes place in June or July, and without any watering most surprising results are obtained. One hedge that I saw had been sown, I was told, less than two years before, and the saplings were already seven or eight feet high and eight or nine inches in girth. I sowed some Neem and Acha (*Hardwickia binata*), which was the only seed I had at that time, on this principle in October 1903 before the north-east monsoon was over. The Neem seed was unfortunately all eaten by rats and never germinated. The Acha seed germinated, and in the following February I dug out one of the seedlings for examination. I did my best to get the whole root system out, but after digging down as far as I could get my arm in I had to break off the two rootlets. The length of the root system which

I dug out was three feet from the column, and the root below the column was the thickness of an ordinary pencil. I then dug out one of the plants which had been planted in the neighbourhood in a pit 18 inches cube and had been regularly watered since July, when it had been planted. This I found had hardly grown at all and had a comparatively weak root system. The general appearance, too, of the seedlings sown on the mounds and unwatered was far healthier than of those which had been planted and watered.

The explanation of the vigorous growth of plants sown in this manner and of their not requiring water is, I believe, that the soft earth in which they are sown induces a very strong development of the root system and that the heap of earth retains moisture at a higher level than would ordinarily be the case. In digging out the Acha seedling I found the earth quite moist at or even slightly above ground level though there had been no rain for three months and the ground elsewhere was dry.

I went on leave shortly after this, and am therefore unable to say how these seedlings have progressed during the past year. Had I returned to the district I had intended to have tried sowing seeds of different species on mounds on some of the bare spurs of hills that I referred to at the beginning of this note and to have continued the experiment of ridge sowing on the plain areas on a larger scale. I was in charge of North Coimbatore district for a few months on my return, and made a series of ridges 18 feet apart in Sulavazi reserve of the Erode Range, the whole covering an acre of ground. The cost of the operation was only Rs. 5. I only made the ridges one foot high instead of two feet, as I wished to see how the seedlings would do on the smaller ridge. Bigger ridges would, of course, have cost more. Unfortunately it was late in the year and there was no more rain after I finished the sowing, though it was raining when I began the work and the rain had seemed likely to continue. Hence there was not enough moisture for the seed to germinate. As I am now on special duty and unable to continue the experiments, I write this note in the hope that some one else may carry them on, as this method seems likely to solve the difficult problem of reafforestation of blank areas in dry districts.

CORRESPONDENCE.

THE INADEQUACY OF THE FOREST STAFF IN BURMA.

The following figures, which were lately compiled with reference to a certain enquiry, may interest your readers. They bear eloquent testimony to the inadequacy of the present staff in Burma and demonstrate how futile must be all attempts to treat our forests on any but the broadest lines. The total area of reserves is over 20,000 sq. miles, and it is estimated that within the next five years this will have increased to nearly 30,000 sq. miles. Can it be wondered at that Forest Officers in Burma are alarmed at the rapid increase in the area under fire protection without a corresponding increase in both controlling and executive staff?

CAMP :

H. S.

16th January 1905.

	NORTHERN CIRCLE.		SOUTHERN CIRCLE.		PEGU CIRCLE.		TENASSERIM CIRCLE.		AVERAGE.		Figures at close of 1903-04.	REMARKS.
	Reserved Forest.	Unclassed Forest.	Reserved Forest.	Unclassed Forest.	Reserved Forest.	Unclassed Forest.	Reserved Forest.	Unclassed Forest.	Reserved Forest.	Unclassed Forest.		
Area of Circle, sq. m.	4,783	5,044	5,329	43,703	5,292	21,068	4,666	29,348	5,016	29,791		
" " Division "	697	3,578	887	7,284	661	2,646	777	4,191	756	4,425		
" " Range "	133	696	140	1,150	143	569	141	889	139	826		
" " Beat "	35	181	23	186	26	103	41	257	31	182		

FIRE PROTECTION IN THE TEAK FORESTS OF BURMA.

In the August number of the *Indian Forester* Mr. Rodgers gives the following statistics in regard to teak trees girdled in the Toungoo Division :—

Class A—trees damaged by fire and of inferior value ...	299
Do. B— do. do. but of full market value... .	2,057
Total trees girdled ...	3,959

Presumably therefore 1,603 of the trees girdled were undamaged.

He explains that "notes were only made regarding those trees which were girdled." * * * "Class A includes those trees which were so much damaged by fire as to have lost a certain part of their commercial value. Each tree contained a cavity; * * * they were only girdled if there was a fair length of sound timber above." Would he tell us how many there were of those trees which were too unsound to be girdled, as they materially affect the value of his figures?

He includes in Class B those trees which, although damaged by fire, have not yet lost any of their commercial value, and states that in his opinion this damage commenced in the year 1852. Now, I would ask whether it is possible for trees to have remained in a more or less half-dead condition for over 50 years and to have lost none of their commercial value? The damage would probably take the form of killing the sapwood on one side of the trees, in effect partly girdling them; and any timber merchant will tell you that trees which have remained a long time partly girdled, even though sound, are, owing to the inequality of their growth and seasoning, much inferior in value to trees which have grown uninterruptedly on all sides and have been killed by one girdling. In my opinion an examination of the proportion of unsound timber in the Rangoon timber dépôt would give more reliable figures. Of course all unsoundness may not be due to fires, though in most cases I believe it is, but, on the other hand, there is generally a considerable residue of girdled trees left by contractors in the forest as too unsound to be worth bringing out, which would be left out of the calculation.

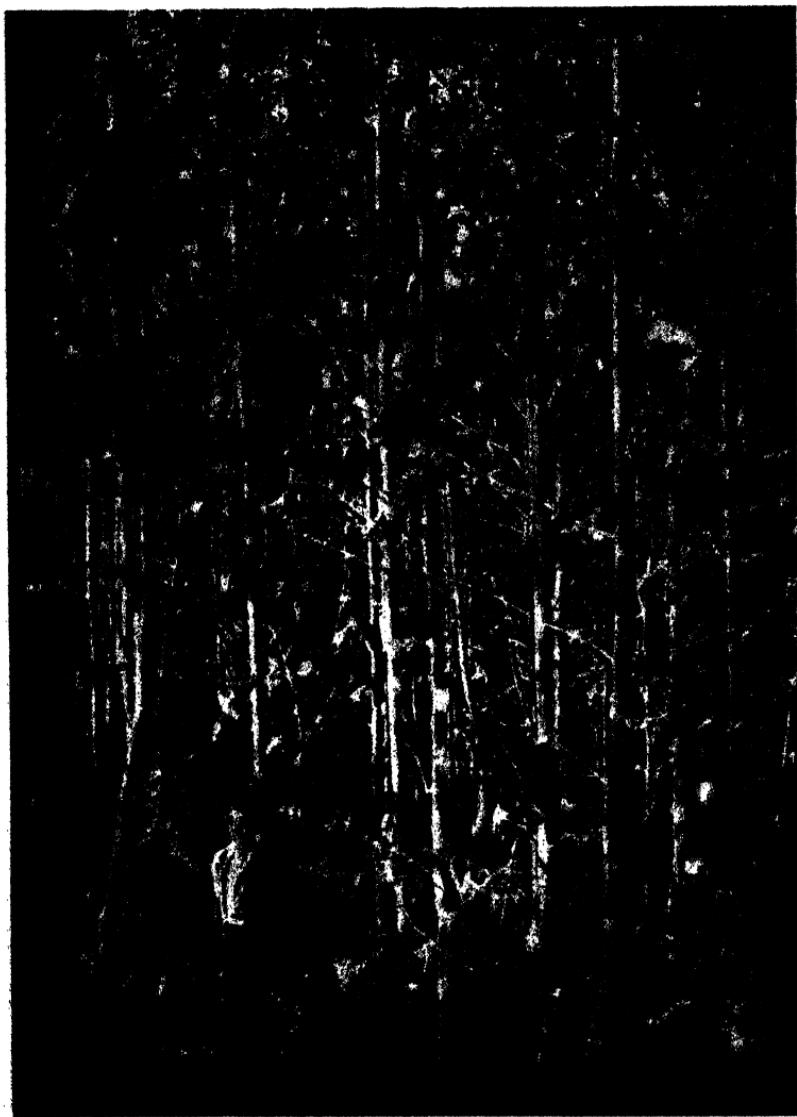
It would be interesting if the officers in charge of the Tharrawaddy and Prome Divisions would give the readers of the *Indian Forester* an account of the present state of growth of teak, especially as regards the younger classes, in the Môkka-Bilin, Bwet, Nyanlè and Kangyi reserves, which are about the oldest fire-traced teak forests in Burma. The Môkka-Bilin reserve, in which the undergrowth is largely *Cephalostachyum pergracile* and *Bambusa polymorpha*, has been under protection since 1873 and the other

three since 1877. In Bwet and Nyanlè the principal undergrowth is, I believe, *Dendrocalamus strictus*, while in Kangyi there are no bamboos over the greater part of the teak-producing area. They should thus afford good examples of the effect of fire protection in different classes of teak forest.

I doubt whether there will be much reproduction of teak in Môkka-Bilin except when the bamboos flower, for, as far as my experience goes, under ordinary circumstances, there is practically no teak reproduction in this class of forest, whether annually burnt or not, as any seedlings which may germinate are almost invariably suppressed by the dense shade of the bamboos.

When the bamboos do flower, judging from past experience, I am of opinion that the judicious use of fire will certainly be advisable. As is well known, the bamboo clumps fall apart when they die and, if not burnt, render the forest absolutely inaccessible for several years, and this state of things is aggravated by a dense growth of climbers which come up and twine round the fallen culms, suppressing or injuring most of the tree seedlings under them. If a fire did occur in a protected area after the culms had become dry (and in spite of all precautions it almost certainly would occur) the damage to the tree growth would be enormous. Wherever therefore there is any young teak growth worth considering, I should choose the least of two evils and burn the forest early every year, commencing with the flowering, until the dead bamboos have disappeared, so as to get rid of them gradually and then protect. The damage to the growing stock in this way would not be so very great, and if teak trees were at hand there would be a fair amount of new reproduction. Where teak is absent and it is practicable to make sowings of teak the forest might be protected till the bamboos were thoroughly dry and then burnt, in order as far as possible to clear the ground for sowing.

Sowings in flowered *C. pergracile* areas, with and without the use of fire, have from time to time been made on a small scale in the Môkka-Bilin reserve and on a much larger scale, after burning, in *D. strictus* areas in the Bwet and Nyanlè reserves. A description of the present condition of these sowings would be instructive.



Photo, J. W. Oliver.

Portion of a 6½-year old patch of Teak Sowings in flowered *Dendrocalamus strictus*,
BWET RESERVE, LOWER BURMA.

I attach a photograph, which is a reproduction of one taken in the early part of 1888, showing what was then a fair sample of the sowings in flowered *D. strictus* made in the Bwet reserve in 1881. The bamboos flowered in 1878 and the reserve was successfully protected from fire till the end of April 1881, when the whole of it was burnt. The fire was very intense and nearly all the saplings and low vegetation were destroyed ; teak suffered comparatively less than other species, except bamboos, but a large proportion of the younger classes were killed outright and even the larger trees were much injured. As soon as the rains began the ground became covered with a carpet of vegetation, principally bamboos and climbers with a good many seedlings of teak and other trees. Sowing and planting of teak was carried on throughout the whole of that rains, and after that sowings of teak and catch for three successive seasons, those first undertaken being naturally the most successful. Similar sowings were also made in Nyanlè, the areas to be worked over being burnt in the hot weather before the sowing.

17th January 1905.

J. W. O.

THE REVIEW OF FOREST ADMINISTRATION IN BRITISH INDIA, 1902-03.

From the remarks on fire protection in Burma in your "Review of Forest Administration of British India, 1902-03," I gather you are under the impression that no special staff is engaged during the fire season, but that the whole work of clearing, sweeping and patrolling in fire lines is done by the ordinary staff of forest guards. This is quite wrong. In some Divisions it is possible to get the lines cut by contract, and then the forest guard has to see that the work is being done according to orders, and that progress is sufficient to ensure its being completed by a certain date. In other Divisions contractors have so systematically robbed their coolies that the latter refuse to work except directly under the forest subordinates. Once the lines have been cut the sweeping and patrolling is occasionally done by contract, but more

generally by coolies engaged by the forest subordinates, as the beat officer has to be constantly travelling along his lines to see that the men are at work. It is impossible to say for what average length of line each forest guard or beat officer is responsible throughout Burma, but it is customary to allow one cooly for every two miles. In the Northern Circle in 1900 there were 1,400 miles of fire traces, which would necessitate the employment of 700 coolies as watchmen, and probably each beat officer is responsible for 15 or 20 coolies. Subordinates under the rank of Deputy Ranger are not as a rule permitted to disburse pay, so the senior subordinates have to be constantly travelling about the fire lines paying coolies. When the dangerous time for burning away from the fire lines arrives every subordinate is at his post, and for probably a month of constant anxiety nothing is thought of but fire protection. Leaves continue to fall right up to the rains, the beat officers have to be constantly on the alert to see that the traces are kept swept. The Burman cooly is not good at a sustained effort, and numerous cases have occurred in which the coolies have got tired and simply gone off home without a word to anyone. This year we are trying Chins in two Divisions, but as they have to be taught what to do and insist upon being paid every second day they can hardly be called a success.

H. S.

REVIEWS AND TRANSLATIONS.

REVIEW OF THE MINERAL PRODUCTION OF INDIA, 1898-1903.

BY T. H. HOLLAND, F.R.S.

We have been recently favoured through the courtesy of Mr. Holland, Director, Geological Survey, with a copy of his Review on Mineral Production in India. The subject is perhaps one not without interest to the Forest Officer, and we propose to give here some extracts from a Report which has proved most fascinating reading.

For the four years 1894 to 1897, a Review of the Mineral Production of India was issued annually by the Reporter on Economic Products; but in 1898 it was decided, owing to the want of uniformity in the rate of development of many minerals, to publish reviews of progress at wider intervals, covering periods sufficiently long to permit the determination of any decided secular variations in the mineral industry. The present Review, covering the period of six years, 1898 to 1903, is the first essay in this direction; but, in accordance with the orders of Government, five-year periods will be adopted for the future, and the Quinquennial Review of Mineral Production will be published in the Records of the Geological Survey of India.

In this Review the minerals are divided into two groups—

Group I.—Those for which approximately trustworthy returns are available; and

Group II.—Those regarding which definitely recurring particulars cannot be procured.

HOLLAND—MINERAL PRODUCTION, 1898-1903.

It has been possible in this report to now include the following in the first group:—Coal, Gold, Graphite, Iron-ore, Jadeite, Magnesite, Manganese-ore, Mica, Petroleum, Rubies, Salt, Saltpetre and Tin.

In the case of Gold, the most precise and elaborate details are obtainable for more than 99 per cent of the production, and approximate values are obtainable for the rest. For Graphite, accurate returns of quantity are obtained from the only company engaged in regular mining for the mineral. Although the returns sent in for the production of Jadeite and Mica are manifestly understated, both minerals are worked largely for export, and, as far as value is concerned, the export figures may be accepted as an approximate estimate of the trade in each case, whilst the nature of the error being known, the figures are not liable to be misleading. Manganese-ore has come into prominence since the older reviews were issued, and may now be transferred to Group I.

as the mineral is worked entirely for export, and the totals obtained from returns made by the District Officers agree very closely with those obtained from the ports. Rubies admit of the remarks applicable to Gold: the amount recovered other than by the Burma Ruby Mines Company may be neglected as an unimportant fraction of the total. Saltpetre and Tin are, with less certainty, entitled to places in this Group. For Saltpetre, the returns for production are evidently understated, being less each year than the quantity exported, but the export figures may be taken as only slightly less than those for the production of refined Saltpetre. The returns for Tin refer to two districts only in South Burma, but the estimates are probably more reliable than those for Iron.

This Review is directed primarily to a survey of the progress already made, and for anything approaching an idea of the material awaiting development the reader must consult the Manual of Economic Geology, now in course of revision by the Geological Survey Department. But besides the substances whose existence has been determined by the exploratory work to which a geological survey is properly restricted with regard to minerals of economic value the attention of prospectors might be directed to the minerals which have lately come into prominence through recent industrial developments, and which, in a country including the geological variety of India, are at present conspicuous by an absence that is probably only the result of absence of search. Amongst these are some minerals of the so-called rare metals, which, being generally of high specific gravity, should be searched for in the heavy concentrates of river gravels.

On looking over the returns for mineral production in India for the past six years, two features stand out most conspicuously. Firstly, there has been a remarkable progress in developing the few minerals which are consumed by what conveniently might be called direct processes, such as Coal, Gold, Petroleum, Gem-stones and Salt, or which are raised for simple export, such as Manganese-ore, Graphite, Saltpetre, Mica and Tin. Secondly, there has been an equally remarkable neglect of the metalliferous ores and the

minerals which are necessary to the more complicated chemical and metallurgical industries.

The principal reason for the neglect of metalliferous minerals is the fact that in modern metallurgical and chemical developments the bye-product has come to be a serious and indispensable item in the sources of profit, and the failure to utilize the bye-products necessarily involves neglect of the minerals which will not pay to work for the metal alone. Copper Sulphide ores are conspicuous examples of the kind : many of the most profitable copper mines in the world could not be worked but for the demand for sulphur in sulphuric acid manufacture, and for sulphuric acid there would be no demand but for a string of other chemical industries in which it is used. A country like India must be content, therefore, to pay the tax of imports until industries arise demanding a sufficient number of chemical products to complete an economic cycle, for chemical and metallurgical industries are essentially gregarious in their habits.

Graphite.—Amongst the minerals which have been taken up more seriously during the period under review, the Graphite of Travancore and the Magnesite of Salem in Madras are noticeable. The Graphite raised during the three years, 1901 to 1903, averaged 3,486 tons per annum, which is quite a serious item in the comparatively small market of this mineral. The total annual production of Graphite in the world varies between 70,000 and 80,000 tons, and the Indian output is thus about 4½ per cent of the total quantity raised, but its value is not returned, and is estimated at £5 a ton.

Iron.—The works at Barakar still remain as the one successful attempt to manufacture Iron along European lines in India. Prospecting operations on an extensive scale have been carried on recently in the Central Provinces, the results in one area being unfavourable, and in the other undetermined. There is a general decline in the native charcoal-iron industry within range of the railways which distribute the cheap imported material, but in more remote parts of the Peninsula the old industry persists, and in parts of the Central Provinces has even improved. In the Sambalpur

District there are over 200 small direct-process furnaces still at work.

Magnesite.—Magnesite-mining was hardly established before the close of 1903, but preparations on a large scale are now being made to open up the well-known deposits near Salem, in which the mineral occurs in a condition of exceptional purity.

Manganese-ore.—The rapid rise of Manganese-ore mining is probably just now the most conspicuous feature in the mineral industry of India. Twelve years ago the industry had not definitely started, whilst last year India turned out a larger quantity of high-grade ores than any country except Russia.

Mica.—Although India is still the leading producer, and is supplying something like half the world's wants in Mica, the miner in India has not secured a satisfactorily large share of the recently increased trade in this mineral, and the returns for India show a smaller degree of expansion than those for consumption in Europe and America.

The returns of production for Mica grossly understate both quantity and value as both are below the export returns. As the only Mica on which royalty is charged is that raised in Government land, and as many Mica miners have mines in both zamindari and Government land, there are obvious reasons for understating the production, and, besides this fact, the flourishing industry of stealing Mica diminishes the returns for production without affecting the export figures.

A considerable quantity of Mica of the poorer grades is consumed in the country for ornamental and decorative purposes, and a small quantity of the larger sheets is used for painting pictures or in various parts of the country. As far as the figures for *quantity* are concerned, therefore, the exports cannot be accepted as an approximate expression of the production; but as regards *value*, the export returns may be accepted as a closer approach to the figures which should express production.

During the years 1897-98 to 1902-93, the Mica exported averaged 19,173 cwts., and had an average annual value of £77,613, or £4·05 per cwt. The variations in yearly value reflect a serious change in the trade which occurred in 1899.

In 1898 Indian Mica miners began to realise that their waste dumps contained a large supply of the material wanted for the manufacture of micanite, in which thin films of Mica are cemented together and moulded into sheets, to serve many purposes for which the natural sheets only were used formerly. The waste heaps were consequently turned over and the clear sheets of muscovite cleaned and split into thin films by gangs of children, who, by practice, could select the films of the required thickness with an accuracy which could scarcely be exceeded by the use of a micrometer. The large

quantities of "flimsy" Mica thus suddenly thrown on to the market raised the weight of Mica exported, without a corresponding increase of value.

During the years under review, the two chief producers contributed to the average total as follows:—

Bengal ...	... cwt. 12,282	valued at ...	... £52,272
Madras ...	... " 6,872	" ...	... £25,241

The average value out of the Mica sent out of Bengal was thus £4·26 per cwt., whilst that from Madras was £3·67.

The rules for the grant of prospecting licenses and mining leases for Mica in Bengal were revised in April 1902, and are printed *in extenso* with those of Madras in the Memoir of Indian Mica published by the Geological Survey in 1902. The important changes introduced in the rules were—

- (1) The levy of a royalty in the case of prospecting licenses at the rate of 5 per cent. on the sale value of Mica.
- (2) The abolition of the system of putting up leases of Mica mines to auction, and provision for restricting operators to approved methods.
- (3) The raising of the maximum period of leases to 30 years.
- (4) The grant of power to lessees to relinquish their grants during the currency of their leases.

Of the prospecting licenses issued during the period under report, seven were granted in Nellore, four in Coimbatore, one in Godavari, and one in the Tinnevelly district, Madras Presidency. In the Central Provinces, one was granted in each of the three districts Balaghat, Hoshangabad and Chhindwara. In Burma, one license was issued for each of the two districts of Magwe and Mandalay, and two each for Myitkyina and the Ruby Mines district. In Assam, one license was granted in the Khasia and Jaintia hills. In Rajputana four licenses were granted in Ajmer-Merwara, making a total of 27 licenses, covering 3,223 square miles.

Petroleum.—The Petroleum industry has increased at a greater rate even than coal-mining, in which in the six years under review the output rose from a total of 4,066,294 tons in 1897 to 7,438,386 tons in 1903, an increase of 83 per cent. From a production of just 19 million gallons of Petroleum in 1897, the output rose to nearly 88 million gallons in 1903, and in addition to the export considerable quantities of paraffin wax, the illuminating oils and petrol refined in Burma and Assam have at last shown signs of definitely displacing foreign supplies in the Indian market.

Rubies.—During the period under review the Ruby-mining industry in Upper Burma underwent a new and favourable phase, the mineral having become, next to the petroleum, the most profitable source of revenue amongst Burmese minerals. Various leases were granted in the Ruby-bearing area near Nanyaseik in the

Myitkyina district, and the "stone-tract" of the Sagyin hills in Mandalay district, and the results have been mostly profitless; but the returns for the Mogok area, where the Burma Ruby Mines Company is paramount, show that the industry has entered a most encouraging phase. The Company was granted the right in 1889 to mine for Rubies and to levy royalties from persons working by native methods, the lease being renewed in 1896 for 14 years, at a rent of Rs. 3,15,000 a year plus a share of the profits. The results being, however, unsatisfactory from the shareholders' point of view, the rent was reduced in 1898 to Rs. 2,00,000, the share of the profits being, at the same time, raised from 20 to 30 per cent. A dividend of 5 per cent was paid for the first time in 1898, when the value of the Rubies obtained amounted to £57,950.

Tin.—Although Tin-mining in South Burma is still practised on a small scale, there has been a marked improvement in the returns, and the persistently high price of Tin is likely to inspire more enterprise in the exploitation of these deposits, which are a natural continuation of those in the Malay Peninsula, from which more than half the world's supply is obtained.

Amber.—The returns for amber show the irregularities which might be expected of an industry conducted in a casual fashion by the half-civilised inhabitants of an unadministered area. The Burmese diggings for amber are situated in the Hukong Valley in the Nangotaimaw hills near Lalaung village. The substance is found in clays of probably miocene age, and fragments of amber have been similarly found in association with beds of this age in other parts of Burma, e.g., at Mantha in the Shwebo District, and on the oil-field of Yenangyat in the Pakokku District. Most of the material is brought from the Hukong Valley in Upper Burma to Mandalay, where beads of rosaries, *nadaungs* (ear-cylinders) and other trinkets for personal ornaments are made from the transparent varieties. The amber of Burma differs in chemical and physical characters from previously known varieties, and the name burmite has been consequently suggested for it. The well-known amber of Eastern Prussia contains from $2\frac{1}{2}$ to 6 per cent of succinic acid, and is consequently known to the mineralogist as succinite, but the

Burmese amber contains no succinite. It is distinguished from many other amber-like resins by its superior hardness and greater toughness, which render it fit for carving and turning. Apart from the occurrence of a large percentage of discoloured and opaque pieces many of the large fragments obtained are damaged by cracks filled in with calcite; but otherwise there appears to be a large quantity of material which might be put on the market with profit. At present it is said to be unable to withstand the competition of imported Prussian amber, even in the Mandalay bazar, and the market has to a certain extent been depressed by cheaper foreign material and by an artificial substance re-made from amber chips.

Clays.—No statistics approaching completeness are obtainable to show the extent of the great industrial value of the clays in India. They include the common clays used all over the country for the manufacture of bricks, tiles and the cheaper forms of pottery; finer varieties used for glazed pottery, which in places has obtained a reputation for artistic merit; fire-clays raised in considerable quantities on some of the Gondwana coal-fields; and fuller's-earth, which is mined in the Central Provinces and in Rajputana.

Diamonds.—Notwithstanding the reputation (stretching back even as far as Ptolemy in the European, and further in the Hindu, classics) which India has held as a diamond-producing country, the output of to-day is very small and comparatively unimportant. The places which, according to accounts, have been most productive in the past form three great groups, each in association with the old unfossiliferous rocks of probably pre-Cambrian age now known as the Purana group, and distinguished locally as the Cuddapah and Kurnool systems in South India, and as the Vindhyan system in the northern part of the Peninsula.

The southern of the three groups of diamond occurrences includes localities, with apparently authentic records, in the districts of Cuddapah, Bellary, Kurnool, Kistna, and Godavari. Loose stones have been picked up on the surface of the ground, found in deposits of alluvium and in workings which have been undertaken in this so-called Banaganpilly stage of the Kurnool series of strata. In

the second group of occurrences in the Mahanadi Valley, the stones have been found in the alluvium of the Sambalpur and Chanda Districts, and though strata similar to those of the Vindhyan and Kurnools are known in this area, no diamonds have been found in these older rocks. The third group of occurrences occupies a tract some sixty miles long by ten wide, with the Vindhyan conglomerates near Panna as the centre. The diamond mining industry still persists in this area both in the old conglomerate of Vindhyan age, and in the deposits which, though described as alluvium, are possibly relics of Lameta (Upper Cretaceous) deposits.

THE NEW BOARD OF AGRICULTURE.

It will not be news to many of our readers that the Government of India have recently constituted a Board of Agriculture. The duties of this Board are, we believe, solely connected with agricultural matters; the improvement of agricultural methods by the introduction of higher quality seed grains and roots, by the adoption of up-to-date machinery and implements, by experimenting with soils and fertilising manures, and finally by the economic study of plant and animal diseases of the crops. The Board has also under consideration a system of agricultural tuition with a view to the distribution throughout the country of men trained in the science of the subject. That such a Board was greatly needed in the Empire is beyond dispute, and the good results that will ensue from its work are almost incalculable.

The first meeting of the Board took place at Pusa on January 6th and following days under the presidency of Mr. F. G. Sly, Officiating Inspector-General of Agriculture, the Revenue Secretary to the Government of India, Mr. J. Wilson, C.S.I., being present as a visitor.

We have been favoured with a copy of the report of the various matters considered at the meetings, drawn up by the Secretary, Dr. E. J. Butler, Cryptogamic Botanist.

The first day was devoted to a consideration of the proposed Programmes of work of the staff of the Agricultural Department.

On the second day questions connected with irrigation, veterinary science (cross-breeding of cattle), and the extension and improvement of cotton were discussed. Cotton cultivation was also the subject dealt with on the following day. The fourth and fifth days were devoted to a consideration of the Publications to be issued by the Department, with measures to bring the Imperial experts into closer touch with the Provincial Departments of Agriculture, and the latter into closer touch with agriculturists and with agricultural education.

We congratulate the Board on their decision to publish a quarterly Journal on general agricultural subjects and in addition to issue separate Scientific Memoirs; and we trust that the day is not far distant when the Forest will be in a position to follow in the footsteps of its sister Department in this respect.

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

ANOTHER SHIKAR INCIDENT.

About six months ago I ventured to give my views on "Shikar" literature in general whilst describing a 'curious incident.' It may be remembered that the incident was consequent on the coming of the Conservator to my Division. Strangely enough the events about to be narrated also occurred immediately following the arrival of the Conservator at the very same camp. McEluire has departed, but Snowden reigns in his stead. It will add interest to the details if I state first the moral of the story. It is this—never be certain who shot an animal until you have examined the bullets inside it. I have often seen a dispute settled in this way, but never before have I heard of the casual extraction of a bullet proving to two men, who were perfectly agreed as to the ownership of a trophy, that they were both quite mistaken.

We were seated over the breakfast table when some one rushed in to say there were "cheetal" in the compound. I went out and saw a large herd of these animals rushing across the far end of the

compound towards the forest, but on arriving at the edge, they stopped and stood gazing at the camp, presenting a grand sight with beautiful skins and swaying forest of horns. There were over a dozen stags and at least nine good heads. I stood watching them while a rifle was being put together, but as it reached me, a shot from Snowden on the other side of the house bowled over one of the herd and the rest disappeared into the forest. Unfortunately the slain animal proved to be a small stag that had pushed itself into the way at the wrong moment ; the bullet, a nickel-coated expanding one from a .400 cordite rifle, had passed clean through its neck. I went into the forest after the herd, and before long got a shot at a fine stag, with a small .400 bore rifle firing a solid lead bullet. As I fired, the animal moved, the cover was thick, and as there was no indication to the contrary I concluded I had missed and returned to camp. On my arrival I was informed that the big stag that Snowden had aimed at had been seen to go away wounded and that a blood track had been found. Men were sent to follow the trail and I settled down to work. About two hours later I was informed by the same trackers that a wounded stag was sitting down close to the camp, and I went out with my .450 express, thinking to polish off Snowden's stag. I came on a pool of blood within 50 yards of the elephant's camp and soon afterwards saw the stag. It immediately got up and was disappearing among dense bushes when I fired into its hindquarters and brought it down. To my surprise I found only one wound on it, and that an enormous rent in the hindquarters. I could only conclude that my bullet had struck it in the same spot more or less as Snowden's. I informed Snowden that I had brought in his stag and went off for another stalk. On my return Snowden produced the base of a bullet which I recognised at once as my .400 solid and remarked "I couldn't find any trace of my cordite express bullet, but here's the one you polished it off with." I stared in amazement, "but," I said, "I polished it off with my .450 express." Then an enquiry elicited the fact, quite unknown to me, that the stag I finished off was found quite by accident and not by the blood trail, which had been lost, and that it could be none other than the stag I thought.

I had missed with my first shot and the solid bullet. Snowden, hearing me declare positively that I had missed my stag and thinking that I had used my solid bullet on both occasions, was naturally as certain as I was that the stag brought in was his.

SOHELWA.

EXTRACTS FROM OFFICIAL PAPERS.

OBITUARY.

It is with the deepest regret that we have to announce the death at Akyab on March 12th of Mr. H. Slade, O.S.W.E., Conservator of Forests, Burma, from the effects of cholera. Mr. Slade had but recently made over charge of the Northern Circle, Upper Burma, and left Maymyo fit and well. He was deputed to inspect Akyab and the Andamans, and left Rangoon for the purpose on March 2nd. We trust in a later issue to give a history of his services together with the Lieutenant-Governor's notification deplored the loss of Mr. Slade's valuable services to his administration.

THE EROSION OF THE HILLS TO THE EAST OF THE SITTANG RIVER, BURMA.

The subjoined extracts from diaries of officers serving in the Tenasserim Circle appear to me to be of sufficient importance and general interest to be recorded in the pages of the *Indian Forester*. The hills affected are those east of the Sittang River in Lower Burma. The reservation of forests has been almost completed in the Pegu Yoma, but the hills east of the Sittang have hitherto been abandoned to the *toungya* cutter. The damage which is likely to result from this cause is foreshadowed in the passages quoted. Mr. Rorie does not advocate reservation because the *toungya* cutters have nowhere else to go. Perhaps

he has not seen the devastation caused by torrents, in the Basses Alpes for example, or in Provence, and has not read such works as those of MM. Demontzey and Surell, and so does not realise the importance of maintaining a dense covering of well-managed forest on the hills to regulate the flow of water in streams.

It has of late years been found that this is a very important matter from the point of view of irrigation, and as a source of electrical energy, permitting the development of industrial enterprises in mountainous tracts where formerly shifting cultivation and pastures were the chief, if not the only, resources of the scanty population.

In the *Revue des Eaux et Forêts* for the 1st December 1904, an article on this subject is given, as an extract from *l' Industrie électrique*, wherein waterpower is picturesquely and suggestively named "la houille blanche." This article is well worth reading. It shows that in nature there are three sorts of regulators of streams, viz., glaciers, lakes, and forests. It is pointed out that the last are much more frequently met with than the other two, and that they act not only as regulators of the flow of water but condense the moisture of the air and bring about its precipitation, the rain of our land in due season, the first rain and the latter rain which is so important for agriculture.

Sometimes one meets with people in authority in Burma who question the necessity of the reservation of the forests for climatic reasons in Lower Burma, on the ground that this country enjoys an abundant and regular rainfall, and that jungle comes up again as soon as it is cut down. They seem to think that "ponzoh" (the re-growth of forest on an abandoned toungya or hill clearing) is quite as good as a completely stocked and well-tended high forest. Foresters, however, know that clean fellings should not be made on unstable hillsides subject to heavy rainfall, but that the system of "high forest" should be adopted, and the method of treatment be that known as "*jardinage*" or selection fellings. But the toungya cutter not only makes a clean felling (as nearly as possible) but also burns the cut material as completely as he can. Deep ravines are formed on these clearings during the rains,

and the silt carried down from them greatly increases the erosive action of the streams and their power of sweeping onward gravel and boulders.

I hope that the facts recorded in the diaries which I quote below will convey a hint that torrents are likely to form and the rainfall to become irregular even in Lower Burma, if care is not taken to restrict the operations of tounya cutters. It is a question of whether they should be allowed to cause devastation, ruin, and death to suddenly overtake the inhabitants of the low lands and sterilise fertile lands which pay far more revenue to the State than do their own miserable "jhums."

RANGOON :

F. B. MANSON.

January 1905.

EXTRACT FROM THE DIARY OF THE DIVISIONAL FOREST OFFICER,
SHWEGYIN, FROM 1ST TO 22ND AUGUST 1904.

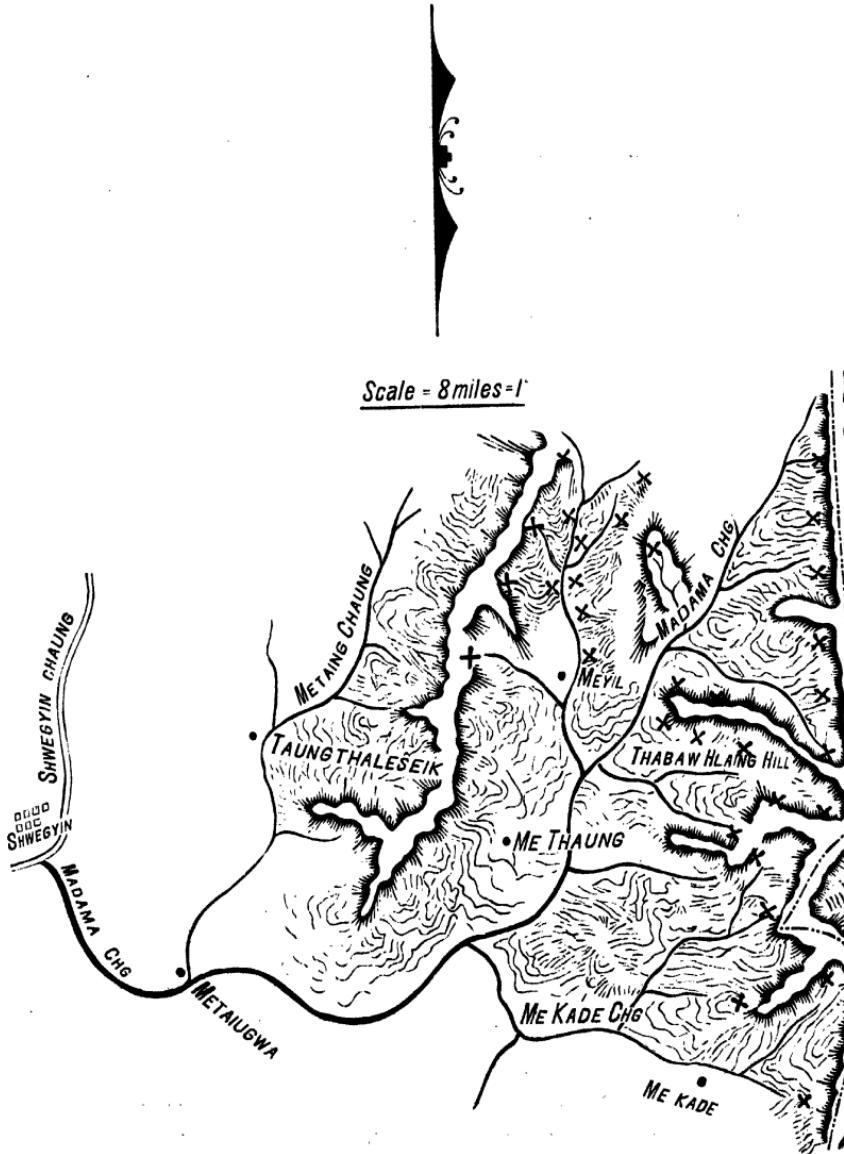
On the night of the 7th August unprecedented floods occurred in the Shwegenyin Chaung (stream), lasting till the 9th. Monster trees, chiefly whitewood and thitkado (*Cedrela serrata*) were brought down with all the bark completely peeled off. A female rhinoceros, dead, was floated to Shwegenyin, as well as cattle, fish, pigs, a bear, fowls, some houses, etc. The water was thick like pea-soup. It is quite evident that some large hill or hills have slipped down. No definite information has been received yet.

The Divisional Forest Officer was written to on the 5th October 1904 and asked to submit a report. The circle "thugyi" was sent to investigate and report. He reported to the effect that on the 10th August heavy rain at the headwaters of the Madama Chaung caused a big flood, which washed away all the houses and property on its banks. Big landslips occurred in the Thabanhlaing, Mayet, Maikah, Hteela, Maikade, Hlaypha and Hteephodoe hills. Seven houses in the Hteela village were destroyed, but no one was killed. Taungyas and gardens were destroyed and many trees, e.g., Thitpyu, Taungkathit (*Erythrina stricta*), Thitkado, Kywedanyin (*Ormosia robusta*) and other species. The landslips are supposed to have been caused by the heavy rain coupled with springs which had started along the sides of the hills.

The area was visited by the Divisional Officer (Mr. Rorie) in company with the Township Officer (Mr. Shircore) early in December, as the villagers who had suffered had applied for a remission of revenue. Mr. Rorie's diary for the week ending 11th December—entry for 7th to 9th—gives a detailed description of the landslips. According to Mr. Rorie, the landslips seem to be confined to the Shwegyin River drainage (*vide* map); those in the drainage of its feeder, the Madama Chaung, are too numerous to be counted. These slips are on the steep slopes on both sides of small ravines on the sides of the hills. The soil on the highest hills is generally a white, coarse, gravelly sand with a thin covering of humus, and containing boulders of all sizes. The rock formation is granitic and of a sort which quickly disintegrates on exposure. The slips are mostly fan-shaped and usually about 30 yards wide at the base, though bigger ones were also seen. The cause of the landslips, Mr. Rorie thinks, is the heavy rain aided no doubt by taungya cutting; but in some cases slips occurred where there were no taungyas, and in others the slips started some 300 yards above the taungyas. The Karens state the rain was exceptional, and that springs appeared in many places on the hillsides. Although it is probable that many of these slips will increase in size during the next five years, the Divisional Officer does not advocate reservation as the villagers have no other land for taungya cultivation.

**EXTRACT FROM THE DIARY OF W. G. COOPER, ESQ., EXTRA ASSISTANT
CONSERVATOR OF FORESTS, WEST SALWEEN DIVISION, FOR THE WEEK
ENDING 13TH AUGUST 1904.**

10th.—Very heavy rain fell all night, and this morning as I was about to shift my camp to Zeebyoung, the Kyunpago Chaung began to rise. In a short while the water came over the bank in a sort of wave and continued to rise. The temporary bamboo bridge over the stream was washed away, and before long a big zayat, the forester's quarters, and some bazaar stalls were also washed away. Some of the property from these stalls was brought to the forest bungalow and kept under the house. The water continued to rise, and it was with some difficulty that I managed to take some of my things into the village; the rest had to be left in



SKETCH MAP SHOWING ROUGHLY
THE POSITIONS OF THE LANDSLIPS
IN THE MADAMA DRAINAGE

REFERENCES

District Boundary —————

Landslips X X X

J. J. Ro

the house. It was found that the water had risen a foot and a half inside the house. The total rise of the river was about 17 feet above the average water level. The Karens tell me that this is about the biggest flood they have ever had. The latrine and cook-house attached to the bungalow were also washed away, and some of my things drifted out of the house and were found in the jungle close by. The bazaar people lost all they had. Before the river rose so rapidly there was a distant sound of thunder or of rolling stones, and some said that there was a landslip higher up the stream.

MISCELLANEA.

PIONEERS OF INDIAN FORESTRY.

DR. HUGH CLEGHORN'S SERVICES TO INDIAN FORESTRY.

BY SIR DIETRICH BRANDIS, K.C.I.E., F.R.S.

I have read with great pleasure the notices which have lately appeared in the *Indian Forester* of the Pioneers of Indian Forestry, and it has occurred to me that some of my young friends may like to read what I wrote in 1890 (*Transactions of the Royal Scottish Arboricultural Society*, XII—87) regarding my late friend Dr. Cleghorn.

KEW :

D. BRANDIS.

December 1904.

Since Forestry is now recognised as an important business in India; since it has become possible, by means of protection, and chiefly by means of protection against the annual ravages of fire, to convert the poor jungles of olden days into dense, well-stocked and productive forests, which yield a large and steadily increasing revenue—and mainly since experience has shown that Forest Conservancy, instead of doing harm to the people of India, promotes their well-being, and is a blessing to them and their country—the question has, naturally, often been asked and discussed, in

which part of the British Indian Empire was Forest Conservancy first started?

In the beginning of the nineteenth century the Government of Bombay established a timber agency on the western coast of the Peninsula, in order to secure a permanent supply of teak timber for the Government dockyards at Bombay. In 1847 Dr. Gibson was appointed Conservator of Forests in Bombay, and ever since that time attempts have been made, with more or less success, not only to work the Government forests of that Presidency, but also to secure their maintenance, to protect and to improve them.

Soon after Tenasserim had become British territory in 1826, repeated, but at that time mostly ineffectual, attempts were made to effect the protection of the teak forests in that Province.

In the Presidency of Madras, Mr. Conolly, the Collector of Malabar, commenced (1843) planting teak on a large scale at Nilambur, and this was the beginning of those famous plantations which have since been steadily extended by the Madras Forest Department, and which are now reported to cover 3,500 acres.*

The object of the present paper is not to decide the question whether Madras or Bombay may claim the honour of having first started Forest Conservancy in India, but to set forth the share which Dr. Cleghorn has had in this business; and hence it will be necessary to review somewhat more fully what was done in this respect in the Madras Presidency, where Dr. Cleghorn commenced his labours.

In May 1847 Captain Frederick Conyers Cotton (Major-General and Companion of the Star of India†) reported to the Government of Madras on the teak in the Anamalai Hills, and asked for the services of an officer to explore the forests. The sanction of the Government of India having been obtained to this proposal, Lieutenant James Michael (now Major-General and Companion of the Star of India) was appointed in June 1848.

* Over 1,800 acres have been added to the area of the plantations since 1890.—
Hon. Ed.

†He died in 1901—see *Indian Forester*, XXVIII, 243.

In August 1849, the Court of Directors called for reports on the results of Lieutenant Michael's work. The terms of the despatch are well worth recording, as evidence of the just views entertained at that time by the Court of Directors. They wrote: "We trust that effectual measures will be taken for its conservation (of the Anamalai Forest), so as to protect it from the serious injury which other forests have sustained."

Captain Cotton then submitted a report on the operations of felling and converting teak, the making of a road across the hills, and the settlement of the Colengode and Cochin boundaries. He also reported the number of good teak trees standing—

In the Cochin disputed territory	...	...	107,000 trees.
In the Colengode	"	...	28,000 "
In the Government territory	...	...	61,700 "
		Total	196,700 "

Minutes were written on the subject by Mr. D. Elliot, Member of Council, and by the Governor, Sir H. Pottinger, and in February 1850 the Government sanctioned Lieutenant Michael's services being retained. In February 1851 he was sent to Moulmein to learn the methods of dealing with heavy timber, in December 1853 to the Kanara Forests, and in 1854 he was formally appointed Superintendent of the Anamalai Forests. The published reports (selections from Madras Records No. V. of 1855) deal only with timber and roads, and there is no reference to conservancy. Lieutenant Michael, however, did more than this—he brought about the lease of valuable teak forests from the Nambadi of Colengode, and he started a system of clearing teak seedlings, and young teak trees, of dry leaves and other inflammable matter in the forests, so as to protect them against injury by the annual fires of the dry season.

In 1856 Lieutenant Michael went on leave, and Captain (later General) Douglas Hamilton was appointed in his place. He was in charge of the Anamalai Forests for several years, and at a later date—after a regular Forest Department for the whole Presidency had been organised—Captain Hamilton was succeeded by Lieutenant (now Colonel) Beddome.

About the time that Captain Cotton first drew attention to the Anamalai Forests, Dr. Cleghorn was stationed as an Assistant Surgeon at Shimoga, in the Nuggur Division of Mysore. Being interested in botany and a keen observer, he remarked the wholesale destruction of forests in that district, chiefly through "Kumri" cultivation. It was mainly through his representations that the attention of Sir Mark Cubbon, then Commissioner of Mysore, and of Colonel Onslow, the Superintendent of the Nuggur Division of that State, was drawn to the necessity of Forest Conservancy. Dr. Cleghorn's name is mentioned in a Report on the Conservation of Forests, which the last-named officer submitted to the Commissioner in May 1847.* In consequence of this report and of Dr. Cleghorn's representations, Kumri cultivation was stopped in the greater part of Mysore and Coorg; and in 1868, while on a tour of inspection through these districts, the writer of this paper had the satisfaction of seeing large tracts of country clothed with well-stocked young forests, which had grown up on the old Kumri clearings.

In 1850, the British Association for the Advancement of Science, at their Edinburgh meeting appointed a Committee to consider the probable effects, in an economical and physical point of view, of the destruction of tropical forests. The report was drawn up by Dr. Cleghorn, and was submitted to the Association, which assembled at Ipswich in 1851. The other members of the Committee were: Professor Forbes Royle, Captain R. Baird Smith, and Captain (now Lieutenant-General) Sir Richard Strachey. The report gave an exhaustive review of the question as it then stood, and as far as it related to India, and it contributed much to induce influential members of the Government in India and at Home seriously to consider the necessity of organising systematic measures of Forest Conservancy in India.

In the Bengal Presidency it was Lord Dalhousie himself who, as Governor-General of India, carried through effective measures for the conservation of forests, chiefly in the newly-acquired Province

* Report of the Twenty-First Meeting of the British Association held at Ipswich in July 1851, p. 83.

of Pegu ; while in Madras Lord Harris took steps in the same direction. In August 1856, Dr. Cleghorn submitted a report to the Government of Madras, containing proposals for establishing Forest Conservancy. These proposals were sent up to the Government of India for sanction, which was accorded in November ; and on the 19th December 1856, Dr. Cleghorn was appointed Conservator of Forests in the Presidency of Madras. An account of the work accomplished during the first five years of his tenure of this appointment is contained in three general reports and other official documents, which, with other important unofficial papers, will be found in a little book entitled *Forests and Gardens of South India*, published by Dr. Cleghorn in 1861, when compelled to come home on sick leave. This book has done much to promote Forest Conservancy in India. The reader must not expect to find in it the record of a complete and scientific system of forest administration, the introduction of which, under the circumstances at that time, would not have been feasible. But the record of the work accomplished by Dr. Cleghorn during this period shows that he directed his attention to such matters as called for immediate action, and that his recommendations in regard thereto were in the right direction. He justly laid great stress upon the necessity of acquiring a good knowledge of the principal trees and shrubs, as well as of the climate, soil, and forest growth in the different forest tracts ; he arranged for the supply of timber, charcoal, and firewood ; and in regard to the protection of the forests, he studied the chief sources of injury, indiscriminate cutting, fires, and Kumri cultivation. The result of his persistent representations was that, by an order of May 1860, the Government of Madras prohibited Kumri cultivation in Government forests without previous permission, and directed that this permission should be given sparingly, and never for spots in the timber forests. Dr. Cleghorn had thus accomplished for the Madras Presidency the same result which, thirteen years previously, he had helped to bring about in Mysore, and in both cases the result accomplished through his persistent representations has been most beneficial for the country and its inhabitants. Dr. Cleghorn was able to carry his point in

this matter, because he was known to be a true friend of the natives; he entertained feelings of warm sympathy towards them, and had made himself familiar with their mode of life and system of husbandry. As a medical man his name was widely known, and he had acquired much influence among the native population. When urging the discontinuance of Kumri cultivation in Madras as he had previously urged in Mysore, he knew that he was proposing measures which in the end would be highly beneficial for the people themselves. Dr. Cleghorn's single-minded desire to promote the welfare of the people was known to those who at that time were in influential positions in Madras, and the confidence which they placed in him was the secret of his success in this important matter.

At a later period Kumri was unfortunately again permitted in Mysore, and in Madras the beneficial effect of the order of 1860 has subsequently to a great extent been rendered nugatory by the tendency, which for some time prevailed in that Presidency, to regard as private property a large portion of the forest lands, particularly in South Kanara, that had formerly been considered to be the property of Government. These subsequent mistakes, though they have done great injury to the country and its inhabitants, do not in any way diminish Dr. Cleghorn's paramount merit in this matter. He paid great attention to a proper arrangement of cuttings, so as to secure the maintenance and promote the natural reproduction of the forests. Under his direction numerous new plantations were established, while existing plantations were maintained and extended. Establishments for the protection and proper management of the forests were organised in all districts. The time had not yet come for comprehensive forest legislation, but local rules were issued by Government on his recommendation, which for the time being were sufficient.

On Dr. Cleghorn's return to India in November 1861, he was directed by the Governor-General in Council to proceed from Madras to the Punjab, in order to examine the forests in the Western Himalaya, with a view to obtain reliable information regarding the timber resources of that Province, and to institute

a systematic plan of conservancy and management. The exploration of the forests in the hills occupied the summer months of 1862 and 1863, while the winter months were devoted to the inspection of timber depôts, brushwood tracts of the plains and the preliminary arrangements necessary for the formation of the Department. His Report on the Forests of the Punjab and the Western Himalaya, which was published in 1864, sets forth the results of his work, and has been of great value in facilitating the organisation of forest administration in that Province and in those Native States of the Western Himalaya where it was possible, by means of leases, to obtain the control of the forests. His work received from the Lieutenant-Governor of the Punjab great praise, and the Governor-General in Council expressed his concurrence in the high estimation entertained by the Punjab Government of his services.

Meanwhile (in October 1862) the writer of the present paper had been summoned from Burma, where he had been in charge of the forests since January 1856, to advise the Government of India in the general organisation of Forest business. On his recommendation, Dr. Cleghorn was associated with him on the 1st January 1864, and remained in that capacity attached to the Government of India until 1st March 1865. Previously, in August 1863, these two officers had drawn up a joint memorandum, which was sent to the Government of Madras, and which urged the necessity of early demarcation of the Government and village forests in the Madras Presidency. These proposals were not, however, at that time approved by the Madras Government, and it may here be added that, in spite of the persistent representations subsequently made on the same subject by the Government of India, no adequate action was taken in Madras towards effecting a separation of the various rights and interests in the public forests and waste lands until the Madras Forest Act was passed in 1882.

In April 1866, while the writer of the present paper was on leave in Europe, Dr. Cleghorn was appointed to officiate as Inspector-General of Forests until April 1867, when the thanks of the Government of India were conveyed to Dr. Cleghorn for his

long and successful labours in the cause of Forest Conservancy in India. On his return to Madras, he resumed his work in that Presidency with his former zeal and industry. That, nevertheless, during that period much less progress was made in the forests of Madras than in those of other Provinces of the Empire was due to the views of the Government of Madras, which at that time began to manifest themselves. Dr. Cleghorn retired from the service in 1870, but has since been employed every year at the India Office as a confidential adviser to assist Her Majesty's Secretary of State in the selection of candidates for the Imperial Forest Service.

When Dr. Cleghorn laid the foundation of an effective system of Forest Conservancy in Mysore and Madras, Forestry was very little known in India. A commencement had been made in several places, but Dr. Cleghorn was the first to carry out conservancy measures on an extensive scale. His aims were large and comprehensive, but the single-minded devotion to the task which he had set himself gained the confidence of many who might otherwise have been hostile to the new measures advocated by him. A public resolution by the Government of India, of 10th January 1865,* justly designated him as the founder of Forest Conservancy in India, and added—"His long services from the first organisation of forest management in Madras have without question greatly conduced to the public good in this branch of the administration; and in the Punjab also Dr. Cleghorn's labours have prepared the way for the establishment of an efficient system of conservancy and working the forests of that Province."

Since Dr. Cleghorn's retirement from the Indian Service, he has done much for the promotion of Forestry in Great Britain, particularly through the Royal Scottish Arboricultural Society, of which he became a Member in 1865, and of which he has been President on two occasions—from 1872 to 1874, and from 1883 to 1886. It was in a great measure due to his exertions that the International Forestry Exhibition of 1884 was held with such marked success at Edinburgh.

* Parliamentary Return on Forest Conservancy, Part I, India, 1871 p. 95.

LOSSES FROM FOREST FIRES IN THE ADIRONDACKS IN 1903.

The following extract from a publication issued by the United States Bureau of Forestry is of interest :—

The fires caused no loss of human life, although several narrow escapes occurred. A few domestic animals are known to have been killed.

For the game the results were more serious. The breeding and nesting season was at its height, and for this reason there must have been great loss of weak young animals and birds. The bodies of several deer were found. The trout suffered severely. In a number of towns dead fish were seen floating down the streams. In one case several bushels of fish were found washed up on the shore of a lake near an inlet. Along the West Branch of the Ausable River considerable destruction took place. On the Boquet River, two boys waded the streams and in a single day took 92 brown trout, weighing 74 pounds. The fish seemed hardly able to move, and were easily caught in the hands. In shallow streams the heat alone was probably sufficient to kill the fish. In deeper streams it seems more likely that lye leached from the wood ashes, or the finely divided ashes themselves, had a poisonous effect. In this connection the after-effects of fires on trout streams must be taken into account. Trout require clear cool water. The loss of heavy shade and the washing of impurities from burned areas into the mountain brooks cannot but have an unfavourable effect on the fish.

The aggregate value of property destroyed, as reported from the best attainable source, amounted to a total area of \$ 1,131,990.

This comprises standing timber, logs, lumber, pulp wood, fire wood, tan bark, logging camps, houses, barns, hotels, cottages, sportsmen's camps, bridges, and fences—all of these items are estimated at the commonly accepted value placed upon them in their locality. This varies considerably in the case of forest products, according to the varying expense of transportation to market more or less accessible localities. In

estimating the total loss, the following considerations have been borne in mind :—

(1) The total area injured by fire has not been considered as a basis for this report but only burned-over lands within the Adirondack Park and its immediate neighbourhood.

(2) The constant and evident tendency of corporations and heavy landowners within the area canvassed was to minimise their losses—no doubt for excellent business reasons. One large Paper Company, which was known to have lost heavily, declined to give any information.

(3) No allowance has been made for the considerable difference in value between lands in private preserves and the rest of the Park. This difference is created by special use to which the land is put, but is none the less actual and marketable. Land which is of practically no value for timber may be worth \$25 an acre when included in a preserve. But it is worse than useless when burned over, since its ugliness depreciates the parts of the holding which may have been saved from the fire. A number of the Adirondack preserves were badly burned this year. The manager of one of them gives his loss as \$225,000, though the actual commercial value of timber destroyed was probably not over \$ 40,000.

(4) Damage to reproduction, or the young forest growth, should be considered a heavy loss, since upon it depends the forest of the future.

It will be seen that the accurate determination of the losses is an impossibility. The figures form a basis for an estimate of the actual money loss, and these are known to understate the damage which was inflicted. The careful consideration of these data and of the modifying considerations mentioned has resulted in the belief that the total damage and resulting loss is not less than \$ 3,500,000.

METHODS EMPLOYED IN FIGHTING THE FIRES.

In New York the official care of the State's interest in the Adirondack and Catskill forests, and the administration of the Adirondack and Catskill preserves, are under the direction of a

Superintendent of State forests. A Chief Fire Warden has charge under him of all matters of fire protection and prosecution of offenders against the fire laws. Both of these officers are appointed by the Forest, Fish and Game Commission. The Commission also appoints a Fire Warden in each forest town, upon whom rests the responsibility of fighting all fires within his territory. The towns are usually divided into convenient districts, each of which is guarded by a Deputy Warden. These Warden Officers are empowered to order any able-bodied man out to fight fire, and have full direction of the work. The State shares equally with the town in paying for such labour if the Warden certifies that the work was authorised by him and was actually performed.

Had there been no such organisation the losses of this year would have been much more severe and extensive. In the main the wardens showed intelligence and zeal in the performance of their duties, and made a gallant fight against odds which were frequently overwhelming. In some cases they and their men worked fifteen hours a day for a number of consecutive days, some to be prostrated later by sickness following the long strain and complete physical exhaustion. The various communities and the State owe such men a debt which pay checks cannot cancel. The blame for the avoidable loss lies rather with the system than with the men.

The most effective fighting was done from daybreak until about 9 o'clock in the morning. The fires were usually much deadened at this time of day, and the wardens took advantage of the fact, resting their men or acting chiefly on the defensive in the middle of the day, and renewing the attack towards evening when the fires again lost some of their aggressiveness. Surface fires were checked by raking away the litter on the forest floor in a path a few feet wide, which served as a line of defence from which the fire could be fought back as it approached. When water could be obtained the path was thoroughly wet down. Shovelfuls of sand were dashed upon blazing wood. Burning grass in the clearings was thrashed out with the bushy top of a young spruce or balsam, or a few furrows were turned with a plough across the track of the fire

But usually the presence of duff made it necessary to dig a trench from one to four feet wide down to the mineral soil, sometimes completely encircling the fire. The roots were cut through with axes and mattocks, and the mass of petty material chopped up and shovelled out. Often the sand was heaped against the outer side of the trench to protect the duff from sparks and heat when the fire burned through the inner side. Several wardens report digging 15 to 20 miles of such trenches.

When other methods failed or could not be used, the wardens resorted to back firing. Often the fires became crown fires, or were of such volume and heat that men could not approach them. In such cases trenches were prepared, and fire was applied all along the side next the approaching forest fire. If the trenches could then be defended successfully for a short time, the fires thus set would burn a distance back from the trench, thus clearing away much of the combustible matter and robbing the conflagration of its energy when the two lines of fire finally met. Most of the wardens who employed this expedient report good success in its use, and some say that without it they could have made no effective defence at all.

These methods were fairly successful as long as enough help could be had and there was no strong wind. But about May 28th to June 3rd (the latter being the worst day) high winds occurred in the Adirondacks, fanning smouldering fires into activity. As a result fire fighting became generally ineffective; the woods became so hot and smoky that everyone was compelled to take refuge in the clearings and to confine his efforts to an attempt to save the threatened cottages, camps, hotels, and farm buildings. The destruction of the entire region seemed not at all improbable, for in the dense pall of smoke it was impossible to tell where the fires were. In some localities these unseen fires could be heard distinctly, and the nights were almost as bright as the days from the glare. People frequently slept on the floors to avoid the smoke.

It was only the timely appearance of heavy rains, beginning June 7th, that brought the fires under control. Hundreds of men

dropped their tools that day and slept the sleep of utter physical exhaustion. Another week of strain would have beaten down all defence.

Fire fighting had been carried on practically without cessation for six weeks. It cost the State, local authorities, and corporations, taken altogether, somewhere in the neighbourhood of \$175,000. Each town must pay one-half its authorised fire bill. This will work hardship in many towns of small population, for the bills of some of them amount to as much as \$10,000 or 12,000. To meet one-half this amount will require a decided rise in rate of taxation, or possibly the issue of bonds.

FOREST ADMINISTRATION IN MYSORE.—We have received several lengthy communications from the Conservator of Forests, Mysore, with reference to the review on the management of the forests in that State which appeared in our issue of December last. We regret that owing to the heavy demands made upon our space we are unable to devote more of it to this matter. In his letters the Conservator repeats the remarks which appeared in full in his communication to the *Madras Mail* last year, which we have already noticed. The gist of his contentions appears to be that the writer of the review in question has quite failed to grasp the forest situation in Mysore, and that far from being in a backward state the forest management, under its present Conservator, is in a high state of efficiency. We feel confident that our readers will be extremely interested to receive this assurance coming from such a quarter. We trust that the great number of important questions demanding attention in our columns may not preclude the possibility of our devoting space to a notice of the next Forest Administration Report of this State.

TIMBER SUPPLY IN AMERICA.—At the American Forest Congress to-day (January 6th, 1905) the Railway officials mentioned that the supply of white oak and yellow pine would be soon exhausted, and suggested the cultivation of the yellow locust tree. It was stated that the railways paid \$45,000,000 annually for wooden

ties (sleepers) for which there was no substitute. Referring to deforestation, Mr. Roosevelt said that if the present rate continued a timber famine would be inevitable. Mr. Roosevelt pointed out that he had repeatedly recommended to Congress the creation of a national forest service, concentrated in the Department of Agriculture. The President stated that he was glad that Western sentiment favoured the setting aside of national forests which the administration's policy would render more actively and permanently useful. Much remained to be done, but permanence of the timber supplies was more nearly assured at present than it was previously.

THE RIFLE IN COLD CLIMATES.—Among the experiences gained by our soldiers in Tibet was that a rifle taken to a very cold climate needs special care if its efficiency is to be preserved. In this it is very human, and the importance of properly protecting the mechanism of rifles in such circumstances has led to the issue of the following Army Order :—Rangoon oil when subjected to great cold becomes thick and causes misfires by checking the action of the striker. In cold climates, therefore, Russian petroleum oil (*i.e.*, paraffin oil) will be substituted for Rangoon oil, and may be drawn in lieu of it in places where the temperature falls below 10° Fahrenheit. The removal of all oil from the firing mechanism and the substitution of paraffin sparingly applied is a precaution that should be inculcated on all troops operating in places where the temperature falls below the freezing point of oil.

SWEDISH FORESTS AND SAW MILLS IN ANCIENT TIMES.—The Norrland forests have from time immemorial been so extensive and dense that they were considered almost impenetrable, but since the country became more and more peopled they were so greatly trespassed upon that the Government was soon compelled to take them under its protection.

By a bill in 1542 King Gustaf I declared that all such possessions which lay far distant from the villages should belong

to the Government and Crown of Sweden. Trespasses against this royal ukase were certainly punished during the lifetime of this vigorous king, but misuse of the forests gradually crept in, because the Crown omitted to guard its reputed estates. Owners of farms included in their estates and villages miles of distant Crown forests, the territory of which some times extended to the mountains. To check such undue interference a royal ordinance was issued by the great economist Carl XI on 13th December 1683 to governors, etc., to protect the forests. Further forest orders were issued in 1730, 1734 and 1741. That the foregoing were not sufficient protection for the forests appears evident from the complaint of the mineral surveyor in Vesternorrland thirty years later.

CAMPHOR IN CEYLON.—At a recent meeting of the Ceylon Agricultural Board H. E. the Governor read interesting extracts from a letter which he had received from Sir Thistleton Dyer, Director of the Royal Botanic Gardens, Kew, London. Sir Thistleton wrote: "I have long urged the cultivation of camphor. I believe it is much in demand in the manufacture of celluloid, and the Japanese virtually have a monopoly of it in Formosa. Apart from this the wood ought to have a commercial value." Sir John Keane, who has visited Formosa, told a representative of the *Times of Ceylon* that camphor wood was very hard and durable, and the river boats in Formosa used to be entirely composed of it. But now it was required more especially for the manufacture of camphor. The Japanese, said Sir John, cut down the camphor trees entirely—they grow in virgin forests—and prepared the camphor from the hard wood in the centre of the trunk, which naturally yielded a larger supply than the trimmings do as in Ceylon. Sir John said he understood that in Ceylon only the branches were lopped off and used.

THE NEW FOREST OF DEAN SCHOOL OF FORESTRY.—Mr. Stafford Howard, Commissioner of Woods and Forests, is considering the advisability of admitting a limited number of working woodmen from 21 to 25 years old into the new School of Forestry, Forest of Dean.

RUBBER AND FIBRE CULTIVATION IN MADRAS.—Important experiments are being made in the production of rubber and fibres at the Government plantations at Benhope, Burliyar and Katlar in the Madras Presidency, where their cultivation has attracted much attention from planters and others in Southern India who have taken up the exploitation of these products in addition to tea, coffee and cinchona.

APICULTURE IN THE KHASI HILLS.—The Assam Agricultural Department are taking steps for the improvement of apiculture in the Khasi Hills, one of the few places in India where it is said to be systematically practised. The method of rearing in those hills is crude, and said to be not unlike the old system of rearing bees in skeps practised at Home. It is intended to bring the bar-frame hive to the notice of the Khasi rearers after careful trial at the Government Experimental Farm at Shillong. Apiculture, as an important industry, is practically non-existent in India, but that money can be made out of it is testified in a recent official report on the production of bees-wax in the country.



Marsh Hall, the Main Building of the Yale Forest School in New Haven, Conn.

INDIAN FORESTER

MAY, 1905.

FOREST ADMINISTRATION AND REVENUE MAKING.

A decade ago an important pronouncement on Forest policy was issued by the Government of India.* The Resolution contained a masterly summary of the case for the forests as it stood at the time ; existing defects in the administration were pointed out especial attention being drawn to the directions where the management pressed too hardly upon the ryot ; the Paper then proceeded to lay down the lines which it was desired should guide their future policy. We may shortly summarise these latter. They have been often quoted and were dealt with in leaders published in the *Pioneer*† two years ago. The principle was enunciated that considerations of revenue from district and village forests should ordinarily be subordinated to the satisfaction of local requirements and to the contentment of the peasantry. This principle was chiefly to apply to village and district forests, from which local needs are chiefly drawn. The Resolution classed the great timber-producing reserves as "forests which afford a supply of valuable timber for commercial purposes," and stated that these were to be managed mainly on *commercial* lines as valuable properties of, and sources of revenue to, the State. We have italicised the word 'commercial' for reasons which will be apparent later.

In a February issue of the *Englishman*‡ a leader appeared in which, under the significant title of 'Revenue hunting in Forest Administration,' the writer endeavoured to show that certain of the principles laid down in the Resolution are not only not being carried out by Local Governments in the manner intended by the Government of India but that the intentions of this latter are

* Resolution No. 22 F. of October 19th, 1894.

† The 'Pioneer,' February 25th and 27th, 1903.

‡ The Calcutta 'Englishman,' February 13th, 1905.

apparently misunderstood. The writer, who displays a considerable knowledge of the subject on which he descants, acknowledges that full credit should be given to Local Governments for having carried out to the full the Government of India's wishes as regards supplying the ryots with their requirements in the way of free produce and grazing. It would have been difficult to do otherwise when we read in the last Annual Report of Forest Administration in British India* that produce to the value of Rs.33,21,957 (or one-sixth of the gross revenue collected in the State forests) was given free to those resident in the neighbourhood of the forests, and that the value of free grazing equals the amount of revenue collected under that head. The leader-writer however, continuing, pertinently asks "Why was it not then declared that if the subordination of revenue making to the satisfaction of local requirements held good for the minor forests and reserves nearest to the villages, many of which forests will eventually disappear, revenue considerations must for at least equally strong reasons be assigned a secondary place in the management of those great permanent State forests with which the villager is less concerned? The correct answer is that, however much the proposition may be contested in theory, the Forest Department was then and is still regarded as primarily an agency for the collection of revenue."

In support of his contentions the writer instances the various forest reports of Local Administrations and the Government criticisms upon them, noticing the marked prominence given in these latter to the financial balance sheets ; he points out that in the more backward localities, where few or no regular working plans exist, the chief question appears to be 'revenue hunting,' and in a subsequent paragraph writes 'In a province which prides itself on a settled forest administration and whose collection of standing forest orders is at least weighty in avoirdupois, the native forest officials are formally discouraged from entering their forests, unless for every journey or day's work noted in their diaries they can show that they have made revenue. Consequently many of these reserved forests have been so assiduously hunted over for anything which shall sell

* Vide p. 41 of this volume.

for revenue that all mature and half-mature saleable trees have been cut out, while the legitimate revenues of future years have been anticipated for several decades to come. Yet the local authorities, from motives of economy (save the mark!) and in view of the small total provincial revenue realised, hesitate to spend the few thousand rupees which would enable them to procure an adequate supply of trained native officials from Dehra Dun and to permanently organise the forest operations.'

The writer holds that in some parts of the country the responsible authorities fail altogether to realise that Government in respect of its reserved forest property especially is in the position of a trustee whose bounden duty is not merely to conserve but also to improve the estates confided to it as the guardian of public interests in the days to come. He states that case after case might be mentioned where this principle is being defied in the hunt for revenue. He insists that the sole justification for 'reserving' a State forest in India (*i.e.*, for declaring it public property and placing it under a severe penal law) is that the forest is required permanently for the welfare of the country generally, and that this carries with it an absolute obligation to maintain and to enrich it, if it needs enriching, as it almost invariably does. This obligation, he states, is being often overlooked or purposely evaded. The writer certainly has the argument on his side when he alludes to the training of the subordinate staff. A forest is a bank, and it is needless to say that the higher the efficiency of the staff the richer will that bank become.

Continuing, the article maintains that charges for the improvement of the growth and the future timber are usually promptly negatived either because no immediate profit will ensue or because a certain fixed quota of provincial nett revenue must be forthcoming. The 'point is,' he says, 'that future interests are sacrificed to present needs. This is mere lumberer's work, not State forest economy.'

Whilst we are of opinion that the writer has perhaps not stated his case with that impartiality which such a subject requires, his article undoubtedly provides food for serious reflection. The

question is not here alluded to for the first time, and few, and least of all the layman himself, could peruse the provincial reports of the last decade and the Local Government Resolutions thereon and fail to perceive that the question, one might term it the principle, of revenue making does unduly influence that of the management of the great timber reserves of the country, as far as the Local Governments themselves are concerned.

The writer of the article under consideration has pointed out, the reasons which led to the reservation of these reserves, but asks whether the spirit in which they are being managed is in concurrence with that of the Government of India Resolution of 1894. On the other side we have the question often put why, with a Forest Department in the country, is it not always possible to meet local provincial requirements of timber? The answer is comparatively simple, and yet it is possible that it has not been realised as widely as should be the case.

It will be admitted that in all commercial requirements it is to the open market that one must turn to ascertain the true price of a commodity. In India we see the Railway Engineer, Roads and Buildings, Mines, City Corporations, etc., going to this market, and the timber they obtain there is not invariably India-grown or even if so it may not come from the Government Reserves. What are the reasons for this apparently anomalous state of affairs?

1. There still exist in the world great virgin forests under no sort of State control where the lumberer holds sway. The timber extracted from these pays no royalty or, if any, a negligible amount, and thus the wood can be put on the market at a rate which will cover cost of extraction and lumberer's profits. It will be easily understood that such timber can easily compete with the local product of even distant countries where the proprietor naturally wishes to obtain the value of his wood, irrespective of the cost of extraction, carriage, and perhaps middlemen's profits.

2. The accessible forests in India had been practically ruined by a long course of neglect when the Forest Department was formed, and true forest conservancy, which aims at bringing on to the ground a normal crop of trees, entails the closing of such

forests to heavy cutting. In other words, selection fellings are necessary, and this means the removal of trees here and there over the area with a consequent small profit on the transaction and an increased price on the wood extracted.

3. Forests which still contain large timber in considerable quantities are at present so inaccessible through the absence of good provincial intercommunications that they are practically unexploitable.

The large virgin forests alluded to under 1 are rapidly being cut out, and it is becoming more evident each day that another decade or so will see supplies from this source at an end. States will then have to rely on their own forests to supply them with the timber which is so indispensable to their requirements, and the price of that timber in the open market will have then reached its real value, not the fictitious one which at present rules owing to the operations of the world's lumberers. It may by then be hoped that our provincial intercommunications will have considerably improved. Thus India will then have to depend upon—

- (a) Its at present inaccessible forests (by then accessible?)
- (b) The timber reserves which the Department are now striving to bring back to their formerly undoubtedly fine condition.

It is with these latter that the criticiser of Local Government policy concerns himself, and we fear that we cannot altogether disassociate ourselves from the epithet of 'lumberer' in respect of these forests. The term is to some extent, probably though a misapprehension of the true position of the case, justifiable, for in some parts of India the idea of forest management is that the lumbering or commercial aspect of the work is the one which should be primarily held in view by the Forest officer. We have seen quite recently a Local Government deliberately drawing the attention of its Forest officers to the fact that they are firstly and pre-eminently timber merchants? Surely the very first principle of true forest conservancy, the first consideration of all countries who have forest estates, is their duty to posterity, and in the interests of that posterity their authority is exerted towards restraining the zeal of the 'timber merchant' Forest officer. We all know how easy it is to mark over an

area for felling if the order is that revenue is to be the first consideration. The lumberer requires no special course of scientific training. The anxiety and mental strain commence when tree-marking for removal on true scientific principles has to be carried out, and to fit him for this duty the Forest officer goes through the most expensive course of tuition obtainable in England at the present day. Further, what does lumbering in a State forest mean? The wood taken from it must be placed on the open market, and under present conditions has there to compete with the product which has paid no royalty on the timber. The consequence is that the wood from the State forest which, if held over for a few years would fetch its real value, is now sold at a price far below it and for one at which it could never be grown. The forests of India are a great inherited property, but although the inheritor has not had to put out the money which produced them, that monetary value is there and is being thrown away by lumbering and enforced sales.

We have noticed this question at some length because, whether the case for revenue hunting in forest administration has been overstated or otherwise, a feeling undoubtedly exists that in parts of India the 1894 Circular has been misunderstood in an important particular and where such a misunderstanding may result in serious harm to, or at any rate in greatly delaying the restoration of, the normal crop in the great timber reserves of the country. Should this really be the case we would suggest for consideration the advisability of a clear definition of the term 'commercial' as used in the sentence of the Government of India Resolution to which we have referred. We may say that we feel confident that Local Governments have equally as strongly as the Government of India the true interests of their great and valuable forest estates at heart and that their desire is to bequeath them to their successors, not only in their present state of efficiency, but greatly improved as a result of their own administration.

SCIENTIFIC PAPERS.

A FURTHER NOTE ON THE PRESERVATION OF BAMBOOS FROM THE ATTACKS OF THE BAMBOO BEETLES OR SHOT-BORERS.

In the Appendix Series of the *Indian Forester* [xxix—12, (1903)]* some notes were given upon the life-history of one of the minute bamboo beetles, or 'shot-borers' as they have been popularly called, and the question of the preservation of the bamboo from their attacks was discussed. The effects of the latter are well known. The insects tunnel into the stem and reduce its wood-structure to powder. It is some years now since Mons. P. Lesne of the Paris Museum, at the request of the authorities of the Indian Museum in Calcutta, examined sets of specimens of these beetles sent home to him. Mons. Lesne reported that the smaller of the two beetles received was a widespread insect known as *Dinoderus minutus*, the second of the two a species unknown to Science, which he named *D. pilifrons*. Up to the year 1903 it was generally supposed that these two beetles worked in company, and that they were to be found distributed throughout India.†

Although the researches which are being instituted into the life-histories, habits and distribution of the two species are by no means complete, it has been shown in the note to which allusion has been made above that the beetle almost invariably if not invariably, responsible for the riddling of bamboos in Calcutta (and possibly to the south throughout the Madras Presidency) is *D. minutus*, whilst its confrère *D. pilifrons* would appear to confine itself to Upper India.‡

A series of experiments and observations were conducted at the Indian Museum throughout the greater part of the year 1903

*A note on the preservation of bamboos from the attacks of the bamboo beetle or 'shot-borer.'

†*Indian Museum Notes.* I, 43; III, 123; IV, 135; V, 166. *Inj. Ins. Ind. For.* p. 42.

‡ *Vide Depart. Not. Ins. wh. aff. For. No. 2, 168*

(as fully detailed in the note in the Appendix Series) with a view to ascertaining whether it was possible by impregnating or soaking the bamboo with some preservative material to protect it from the shot-borer's attacks. It may be mentioned that incidentally, in the course of these experiments, a large amount of information was obtained on the life-history of *D. minutus* and of the reasons which lead to its being such a pest within the area of its depredations.

The bamboos experimented with were some from a lot received at the Government Telegraph Workshops in Calcutta from Northern India. They had been cut in the cold weather of 1902-03. As already explained in the previous note, these bamboos were to be converted into field telegraph posts, and in the hope of giving them some protection against the shot-borer pest they were subjected to a series of soakings in water, copper sulphate and Rangoon oil. For over eight months untreated bamboos and those treated with one or more of the above solutions were kept under close observation, all the lengths experimented with having been received direct from the Workshops, chosen at haphazard by the Superintendent. As a result of the carefully recorded observations throughout this period it was proved that the untreated bamboos were invariably attacked by the shot-borer, *D. minutus*, within a couple of months, i.e., between March and May; that soakings in water alone or water followed by immersion in the copper sulphate solution were equally innoxious to the beetles; but that those bamboos which had proceeded the stage further and had been soaked in the Rangoon oil were immune from subsequent attack by the pest. It was shown that the insect passes through no less than five generations in the year, different swarms of adult individuals appearing in April, June, July, September and October, and that the attacks of one or more of these generations with those of their resultant grubs would ordinarily have reduced the bamboos, if untreated, to powder; it was therefore held to have been proved as a result of the experiments that the life of the bamboo had been lengthened by at least a year as a direct result of the impregnation.

It has since been possible to trace the history of these treated bamboos, all of which were converted into field telegraph posts, a stage further in their career, and the evidence that has been obtained both by the use of the posts in the field and, equally important, by their storage in an open shed without any special protection being afforded to them in the Workshop yard points to the wonderful efficacy of the oil treatment. It is the purpose of this supplementary note to give publicity to this fact, firstly, owing to numerous enquiries as to the necessary treatment to be given to the bamboos, having been received from the Public Works Department, and, secondly, because the oil treatment for the preservation of bamboos may be said to have now passed the rubicon of the 'Experimental Stage' and to have reached the arena of practical utility.

To go back to the bamboos converted in 1903. Some of them were sent up that year for service with the Tibet Mission. They were returned to store in Calcutta about the beginning of the present year, and Mr. L. Truniger, C. I. E., who was in charge of the Field Telegraph with the Mission, has stated that they had fully answered expectations. Some of these returned posts were inspected by the writer in the yard at Calcutta towards the end of March last. Although it was two and a half years since they were cut in the forests of Upper India and close upon two years since they were treated with the oil, they showed no trace of attacks by the *Diinoderus* beetle. It may be contended, and justly, that throughout 1904 these posts had been at an altitude greatly above that at which either of the shot-borer beetles could, or do, live, and that they were thus safe from their attacks. This was so, but the same argument does not hold good when we come to consider those converted bamboos which remained throughout the year in store in Calcutta. An inspection of these has shown that they have remained equally immune from the pest. Most are aware how short is the life, economically, of the bamboo after it has been cut, and many know the difficulties which stand in the path of the lance, the tent-pegging and hog-spear purveyor. The results that have attended the treatment of the 9,000 bamboos in 1903 are well worthy

of the consideration of these latter, for on present observations it has been shown that the impregnation with the oil leaves the bamboo strong and serviceable two and a half years after it has been cut. Arrangements have been made to keep some of these posts under continuous observation with the object of ascertaining the longevity to which the treatment enables them to attain. That the Telegraph Department has the fullest confidence in a discovery the full credit of which chiefly belongs to it, is borne out by the fact that an additional 30,000 bamboos are at the time of writing being put through the treatment and converted into field telegraph posts. It may be stated that the recommendations of the previous note are being followed, the bamboos being first soaked in water for five days (this is very necessary for reasons previously given), allowed to dry for several days, and then re-soaked in the Rangoon oil (crude petroleum), this latter, as used in the Workshops, having the consistency of treacle.

That the use of the bamboo as a field telegraph and telephone post has a great future before it has been proved by the Japanese in the present campaign. The following note upon the subject appeared recently in the *Pioneer** : "Every general of brigade in the field is 'at the end of a wire' which his divisional commander controls and the generals of divisions are in touch by telegraph or telephone with the corps commander. The engineers run wires after the columns with marvellous rapidity. Firing is heard somewhere at the front. A detachment of engineers emerges from headquarters, pack ponies carrying bundles of light bamboo poles, while coolies and carts follow them with coils of slender copper wire. The poles, which have pointed ends, are quickly planted, the wire spreads out as fast as men can uncoil it, and a field telephone is at work." As having a bearing upon the experiments and results attained in India, Mr. Y. Hara, Chief of the Japanese Forest Bureau, was addressed with the object of ascertaining whether the bamboo field posts used by his countrymen were subjected to any treatment. His reply would seem to show that in this matter Japan is in the position occupied by India before the discovery of the

* Allahabad, *Pioneer*, October 24th, 1904.

oil treatment. He wrote : " In answer to your enquiries with regard to a protection of our bamboos, I would state that although the method in preserving bamboos in the field is not well known, there are three processes of treatment generally adopted by our people—

- (1) The season of cutting—September and October.
- (2) The fumigation in sulphur.
- (3) Application of both of these processes."

E. P. STEBBING.

ORIGINAL ARTICLES.

FORESTRY EDUCATION IN THE UNITED STATES.

BY G. HEWITT MYERS, M. F.

EXPERT, U. S. BUREAU OF FORESTRY.

During a recent tour of India, I have been particularly impressed by the similarity of many of its forest problems to those of the United States. It is clear to any forester visiting the two countries that in spite of the difference in the species of trees composing the forests the methods of sylviculture used in India are directly applicable to many sections of the United States. The handling of the spruce and deodar of the hills is far more instructive to the American forester who is interested in the coniferous forests of the North-Eastern States and the Western mountains than the forests of the Alps. In the same way no European forest would help the American in handling the long-leaf pine of Georgia as much as the long-leaf areas of Northern India.

It is of greater value to us to study how others have worked under conditions similar to ours at the present day than to study forests which have been under management for a century. The same is true of the work of organisation, preparation of working plans, methods of inspection and control, and fire protection. What I have said of the similarity between the problems in India and America is likewise true of forest education. The question of training officers of the superior service is specially prominent in

India at this time, on account of the abandonment of the Cooper's Hill College and the establishment of a Department of Forestry at Oxford. What is being done in America in technical education may therefore be of interest to the readers of the *Indian Forester*.

A great deal has been written in the newspapers of different countries about the enormous saw mills of America, the large scale on which lumbering operations are conducted, the immense waste through fire, the loss by timber-stealing, the injury to the forests by grazing, and so forth. An impression has thus been created that the forest conditions of the United States are as bad as any in the world. Until very recently, this charge was justified, and as yet we have made only a small beginning. But during the last ten years, the United States has made a greater advance in forestry than any other nation in double that length of time. Ten years ago, the Federal Government had a small division of forestry under the Department of Agriculture, for which an annual appropriation of some 25,000 dollars was made. This division was engaged altogether in the work of research and a propagandism. There were no Federal reserves, although several national parks had been established to preserve natural scenery in the mountains of the west. At that time there were only half a dozen trained foresters in the country; no forest schools, practically no forest literature, and relatively little public interest in the subject.

To-day the Federal reserves in addition to the national parks amount to over sixty million acres, and many million acres are under consideration for reserves. The Federal Government is now spending annually about three-quarters of a million dollars for administration, protection of reserves, and in research work.* The States individually have also begun to establish reserves, among

* Unfortunately, the forest work of the Federal Government at present is divided among three different departments, and the administration of all the public lands has always been under the general land office of the Department of the Interior. The forest reserves are therefore administered by that Department. The Geological Survey, also in the Department of the Interior, has had charge of the survey, mapping, and demarcation of the reserves, and in connection with this work has carried on reconnaissance examinations of the forest. The work of research, the study of growth, the effects of fire, and grazing, and similar scientific work, fall naturally to the scientific department of the Government, namely, the Department of Agriculture. Under this Department



Stone Cottage : one of the Buildings of the Forest School in Milford, Penn.

which is New York with 1½ million acres, Pennsylvania with several hundred thousand acres, and other States, notably Michigan, Minnesota, Connecticut, and Massachusetts, each with a nucleus for State reserves. These State reserves show the serious interest now taken in forestry in various parts of the country as these reserves have been established under the necessity of buying the lands from private owners. There is likewise a good prospect for a large Federal reserve in the Southern Appalachian Mountains which will have to be purchased at an expense of about ten million dollars. About twelve States now employ the State Forest Officers to administer the State lands and to create public sentiment. State work has been considerably retarded by the disinclination of the State Governments to adequately pay their Forest Officers and to appoint men of proper training.

There is a National Forest Association which has a rapidly increasing membership, now numbering some three thousand members, including foresters, lumbermen, owners of large estates, and game-preserves, etc. In fact, the membership includes men and women of all sorts and conditions in all parts of the country who are interested in bringing before the people the great advantages which will accrue to our national welfare, if we accept the opportunity afforded by the newness of the country, to take hold of sound principles of forestry at an early period in our history. A National Congress is held annually under the auspices of the National Forestry Association at which papers are read, current questions discussed in a more or less popular way, and resolutions passed upon points that affect the proper use of forests. At this winter meeting there are invited to be present men interested in various occupations affected by forests, such as lumbering, grazing,

is the Bureau of Forestry, which is now engaged chiefly in work of research, in advising the land office in technical forest matters, in assisting private owners by personal advice, in co-operating with the several States in developing their forest policies, and so forth. This dividing up of the Federal forest work has led to great confusion and waste of energy. A strong effort is being made to consolidate under the Department of Agriculture all Federal forest work. As soon as this is accomplished the administrative service may be rapidly developed by Mr. Pinchot, Chief of the Bureau of Forestry, who has under him a strong staff of trained foresters.

irrigation, wood-pulp manufacture, mining, and so forth. Besides the regular business of the Association, one day is given up to the discussion of questions affecting each of these industries. A summer meeting is also held which is confined to forestry alone. It is expected that these conferences will be of great value in diffusing a correct knowledge of what forestry aims to accomplish and in showing the foresters themselves what opposition they will have to face. There is a Society of American Foresters whose membership is limited to those who have accomplished some work of importance to forestry. This Club's headquarters are in Washington, where bi-weekly meetings are held for the discussion of technical matters. An election to membership in this Society is a distinction, although little is known of it outside of the profession. There are also numerous State Forestry Associations whose objects are the same as those of the National Forestry Association.

The National Association has an official organ known as *Forestry and Irrigation* (formerly *The Forester*). This periodical is published quarterly at Washington and contains some articles of a technical nature, but for the most part its character is that of a popular magazine.

As in the early stages the development of forestry is still governed by the supply of trained men, officers in the Indian service will readily see how quickly, in a country like the United States, a small number of trained men is swallowed up and lost in the vast amount of work to be done and the rapid development of new branches of work. Step by step with this development and broadening of scope, a distinctly *American* profession of forestry has appeared, and it has become evident that men who have had only European training are not competent to fill the positions now opening in the United States. At the present time such men cannot pass the Civil Service Examinations for eligibility to the Bureau of Forestry without the addition of a field training in the United States. This is a very recent condition of affairs due to the rapid raising of the standard for these eligible lists, which in turn is due to the establishment of American technical forest schools.

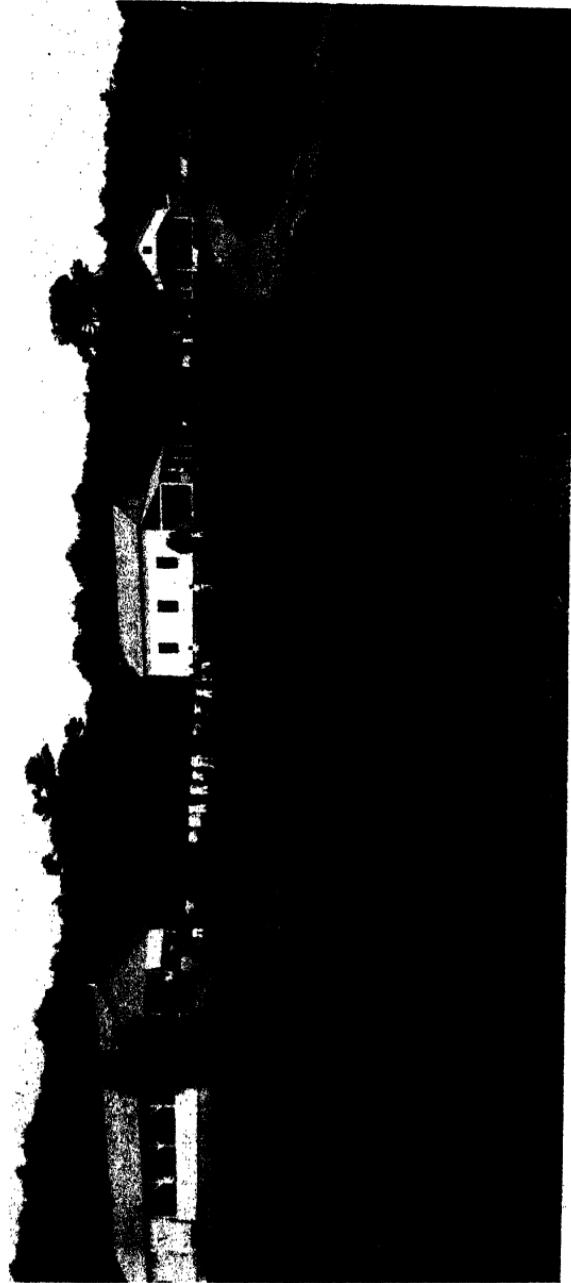


A Corner of the Library of the Forest School.

Up to 1898 it is safe to say that the prospective forest student would have been advised on all sides to go to Europe, probably to Germany, and, what is more, to stay there from one to two years according to previous knowledge of the language, then to return to the United States and begin practical work in the Government service. At present sounder advice would be that he should first study at an American school and then go to Europe for a stay of two to five months according to the time at his disposal. As for the best country for an American to visit, this depends primarily on whether the student knows French or German. Beyond this the relative value of French and German is a point open to discussion, into which I will not enter. The point I wish to make is that in the course of the past five years the standard of forestry education has so changed in the United States that now the home school training is the essential thing and the European trip is at most only supplementary, and it seems probable that the near future will see a still further change in the same direction. Formerly, the European training was supplemented by various sorts of instruction and practise at home, and it was not until 1898 that the opening of a Forestry Department at the University of the State of New York ("Cornell") and of the Yale Forest School two years later made it possible for the prospective forester to begin his professional training at home. That home schools of forestry were demanded is sufficiently shown by the increase in the enrolment at the Yale School from seven in 1900 to sixty or more during the current year. That a home training is the best for practical work seems evident if one considers how peculiarly its own are the forest problems of any country, when viewed in the broadest sense. Of course, there are certain sciences whose principles are universally applicable, such as structural botany and morphology, mathematics, entomology and geology, and to a certain extent the art of sylviculture as well, but all these form only a fraction of what every practising forester must know. On the other hand, how can any man (and much less a boy fresh from school or college) learn in Germany the problems of transport which he must face in the United States, or learn to estimate or

"cruise" standing timber or learn to cope with the complexities of land tenure and labour problems in British India? Needless to say a foreign country is not the place to learn forest botany or the peculiarities of the people with whom he is to deal. This last point is one of vast importance in the United States; the forester must not only learn to deal with the kinds of men who will be his future superiors and subordinates, but he must also have a clear comprehension of the view-point of lumbermen, farmers, cattle-men and sheep-men, railroad managers and wealthy landowners. Most of all, why should a man who is to practise extensive, or perhaps even rudimentary, forestry learn his profession in a country where a thick population, a large peasant class, a paternal form of Government, and a long settled forest administration give the key to the instruction which he will receive and the principles which will underlie his forestry sense? How is one to learn constructive forestry in a country where forestry work is administrative routine? To be sure, much of the forestry work in the United States will eventually be administrative in the service of the Federal Government, in that of the individual States, or large corporate or private holdings. Now, however, the bulk of work lies in developing and encouraging public sentiment in favour of forestry, and in research work which shall furnish necessary data for proper administration when the country is ready for it. The extent and diversity of the necessary research work can be appreciated only by those who have a clear idea of what there is to be learnt in a large and rapidly advancing country whose forest products stand fourth in value in her entire commerce.

Instruction in forestry likewise forms a continually broadening field of work, but this instruction must differ as widely from that of the best of European schools as does the practice in a country where systematic working plans are only beginning to be known. Three kinds of schools are needed to give three separate kinds of training. First, there must be a national (not necessarily a Government) school which shall serve primarily as a feeder for the Federal service. This service in the opinion of its head, Mr. Pinchot, will, in the future, as it has in the past, make greater and greater demands for



Some of the Buildings of the Yale Forest School at Millford, Penn.

first class men. It must have men who are able and willing to do work with their hands and legs as well as with their heads. This does not mean simply that they must have a reasonable amount of nerve and endurance but also the willingness and ability to fell their own trees for stem-analysis or to cook their own food and tend their own horses, if need be. They must be men of sufficiently broad education to take up work in new branches and in new regions, to weigh future advantages and disadvantages, and to adapt themselves to conditions as they find them, unbound by any habit of stereotyped procedure, men who can use their own ingenuity to solve questions for which there is no precedent to aid them.

Second, there must soon be local schools in the different parts of the country where the forestry of the locality, as it develops, may be taught to men who cannot enter the national school.

NOTE.—Such schools have already begun to appear in more or less rudimentary forms, at the Universities of Maine, California, Nebraska, and elsewhere.

Third, there will soon be a need for a school for Forest Rangers; such a school may in many ways be compared to the one at Dehra Dun for the men of the Indian Provincial Service. It will readily be seen that of these three, what I have called a National School is the one first needed. Before speaking of the probable future development of such a school, it may be well briefly to review those which we have. I shall only mention one of the many institutions where the best of instruction may be had in the underlying sciences. At the Arnold Arboretum, a part of Harvard University, are two men whose names are well known in American forestry, Professors C. S. Sargent and J. G. Jack, and who have given their first instruction to some of the best known foresters of America.

NOTE.—In the fall of 1903 forest instruction was begun in the Under-graduate Department of Harvard University under Mr. R. T. Fisher, a graduate of the Yale School.

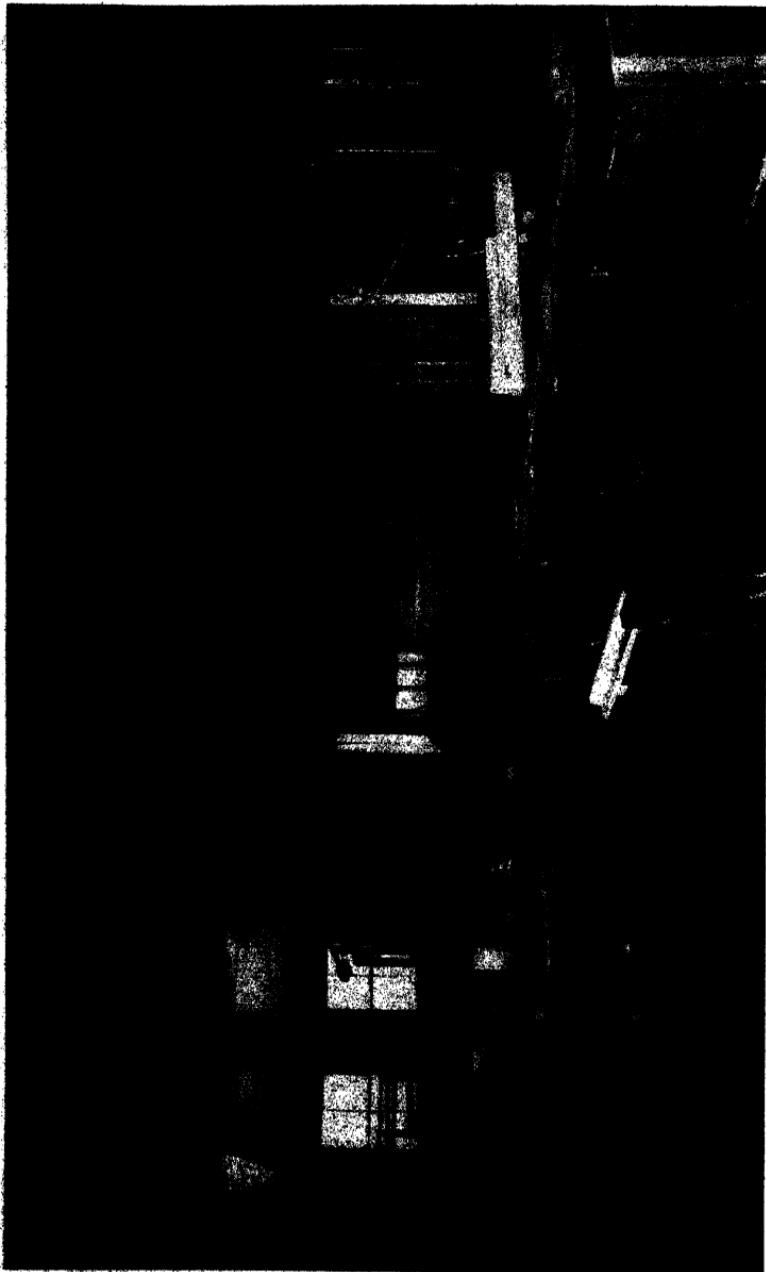
The Cornell School of Forestry was established as a part of the Under-graduate Department of the University of New York

at Ithaca in 1898. This school had two excellent instructors in Dr. B. E. Farnow and Mr. Filibert Roth, and gave a most useful training leading to a Bachelor's Degree in Forestry. Unfortunately, the school was dependent upon an annual appropriation from the New York State Legislature and was suspended in 1903, Dr. Farnow, its former Director, is now editing the *Forest Quarterly*, a periodical of scientific forestry, with a staff of associate editors, which includes most of the prominent foresters of the country.

Private instruction in forestry has been given since about 1897 by Dr. C. A. Schenck at Biltmore, North Carolina, on the estate of Mr. George W. Vanderbilt. The course occupies one year, including a short European tour, and, on its completion, a certificate is given. Its usefulness is vouched for by an increasing number of students.

At the present time, the Yale School of Forestry is easily the foremost in the United States. It gives the most thorough technical training requiring a Bachelor's Degree as a qualification for entrance ; it is the only one on a permanent endowed basis, and is by far the largest in the country. Professor Graves, the Director, is probably the best forester in the United States, and his work in organising the school is the best thing that has been done for American forestry during the past four years. Through the generosity of Mr. Gifford Pinchot and his family, the school was opened in September 1900, as a Graduate Department of the Yale University, and began the year with Professor Graves and Assistant Professor Toumey as instructors in technical subjects, with the regular University facilities as auxiliaries, including such well-known scientists as Professor William J. Brewer. The students numbered seven during the first year, and the writer counts it a great honour to have been one of them. For this reason some allowance may be made by the reader for the following account of what the school has accomplished and hopes to do in the future.

At present there are 30 odd students in each of the two classes. During the four years of the school's existence, the faculty has had to face the above formidable increase in enrolment and a fire which necessitated the re-modelling of the building set apart by the



Wood-Testing Laboratory of the Forest School.

University for the school's use. In spite of these things, however, the course has continually improved. There are two distinct bases for instruction—one in New Haven, where the University is located, and where the principal part of the laboratory and classroom work is conducted ; the other at Milford, Pennsylvania, in a region well known for its white pine and hardwood timber. Here a considerable part of the forest work is carried on : each plant is provided with lecture halls, library, reading-rooms, laboratories and so forth. The accompanying photographs will give an idea of the buildings and some of the rooms. As this is essentially a professional training school, no student is admitted unless he has already received at some high grade collegiate institution a liberal education, including the study of mathematics, language, and natural science. The courses at Yale are, therefore, of a technical character. The graduates are often called upon to undertake work of great responsibility immediately upon leaving the school. For example, several have received offers to teach in colleges giving courses in forestry. One has been sent to the Hawaiian Islands to take entire charge of the insular forests ; others have taken responsible commissions in charge of private estates. In nearly every case the graduates have at once taken up work which they could not have done without a thorough general education. The entering class meets at Milford in July, and spends ten weeks in camp doing forest work with Professor Graves. Each morning the students meet for one or two hours of lectures, and the rest of the day is then spent in the forest. The students learn first to identify the trees empirically, the theoretical work of forest botany being taught later at New Haven. Thus consistently with the whole course of instruction, the student is taught to know something of the trees as they grow in the forest before he is asked to study their botanical and sylvicultural character from text-books. The remainder of the summer term is occupied mainly in the study of sylviculture and forest mensuration. These subjects are likewise taught less from text-books than in the forest itself. One of the first tasks of the student is to learn to fell a tree properly and to cut it into logs, so as to yield

the greatest measure of boards or other products. Each student is required to make stem-analyses of seventy-five to one hundred trees, and to determine their contents ; to construct tables of value, and form-factors ; to make a study of the rate of growth of a given species in diameter, height, and volume and to construct yield-tables. He is not merely told how to estimate timber and study growth, but is required to do the work for himself. In botany, the student must be able to identify trees in the forest both in winter and in summer ; in geology, he must identify rocks in the field, and make soil maps. In engineering he learns to make topographic maps with the transit and other instruments, and also does quick map work, such as is done by Army Engineers. He must be able to lay out roads and trails ; his knowledge of lumbering is based on three weeks spent in a lumber camp in December of the senior year, and he is then required to make a complete report upon the methods in use in the region in which he has chosen to spend his time. In addition to this, most of the students spend the summer vacation at the end of the junior year in field work for the Government. During the course, complete working plans are made by small groups of students and hundreds of trees are planted by each of them. Practise in thinnings, reproduction cuttings and other sylvicultural operations are made upon the lands of several city water companies who have placed their forests under the management of the school. Space does not permit a further description of the actual curriculum, but enough has been said to show that the underlying principle of instruction is in direct contrast to the method of long text-book work in theories and principles at the beginning of the course. Theory and principle must indeed be learnt, but it is believed at Yale that if they are taught first they cannot be sufficiently closely connected with actual forest work to make them of use to the student. Future changes in the course will probably be consistently in the direction of confining the work of the two years' course still more strictly to technical forestry. Less and less of the time will be taken up with teaching such subjects as microscopic botany, entomology, zoology, geology, and so forth, as it becomes possible to demand in entrance



Part of the Summer Camp of the Yale Forest School, Milford, Penn.

requirements more and more of these subjects which can be obtained in collegiate courses. At the beginning of the school, such severe demands could not be made in requirements for admission, but the policy of the school is to take only those men who have already had the greatest possible amount of fundamental work, so that their entire two years at Yale may be free for practice in such work as they will afterwards be called upon to do.

THE HALIYAL TIMBER DEPOT.

BY W. A. TALBOT, I.F.S.

Bombay Forest Officers, retired and in active service, as well as many readers of the *Indian Forester* will be interested to learn that the well-known Haliyal Timber Depôt in North Kanara has been abolished. The last sale of teak and jungle wood was held there a few weeks ago. The whole of the stock of timber was disposed of to the usual purchasers at excellent rates. Nearly three lakhs of rupees were realized. In future the annual auction sale of teak exploited from the fine high timber organized forests of Supa in North Kanara will be held at Tawargatti on the Southern Mahratta Railway line between Dharwar and Belgaum, where a new depôt with buildings has been formed. The advantages of this location are a considerably reduced lead from the forest blocks to be worked during the next 16 years, and the Railway sidings being in the depôt itself, logs can be loaded in consequence directly on the wagons. It will be remembered that Haliyal was seven miles distant from Alnawar, the nearest station on the Southern Mahratta Railway, and the timber had to be carted that distance and again reloaded on the trucks. Haliyal has, however, the distinct advantage of being the centre of a well-established timber trade and has facilities for purchasers which the new location does not possess.

The Haliyal timber depôt was established in 1865 by Colonel W. Peyton (then Captain Peyton), a famous sportsman and excellent forester, Conservator of the Southern Circle, Bombay Presidency, for the storage and sale of teak and other kinds of

timber, cut in the Supa division of North Kanara. Each year one to two lakhs of rupees worth of wood were disposed of, principally to traders from Belgaum, Hubli and Dharwar. This material was afterwards retailed to people usually resident in the Southern Mahratta country. But as the fame of the excellent quality of the Kanara teak and the fine condition of the logs was widespread the wood has frequently been exported to many places far outside the southern parts of India. The logs are squared with the axe in the forests and are dragged part of the way from the forests by buffaloes or carted directly to the dépôt. No elephants being used in the exploitation of these Supa forests the logs are never of very large scantling. When the trees are in easily accessible places the contractors sometimes bring in pieces of over two tons. The general average size of logs is about 3 khandies or three-fourth ton each. The price of teak has been steadily advancing of late years, and as railway and mining companies are extensive purchasers the bidding at the auctions is usually animated. Rupees 80 a ton of 50 cub. ft. was the average of the last teak sale. This rate was, however, only about half of that obtained some time after the great American Civil War. At that (1866) sale teak logs fetched as much as Rs. 180 a ton. The ryots were well off in those days. Colonel Peyton used to relate how a purchaser at this sale arrived in the dépôt carrying a heavy bag of rupees on his back. After walking about and selecting his requirements he went up to Captain Peyton and throwing down his load of rupees with a sigh of relief said "Saheb, I have selected such and such logs ; take what you want and give me back the remainder"—"Bancheso dev." The Southern Mahratta ryots waxed rich in those days over the sale of their valuable cotton. They were, however, usually thrifless, some of them going so far as to fit their common cart wheels with silver tyres. The period of prosperity soon turned into one of adversity, and many of these same ryots, who did not know how to spend their money a few years before, died miserably of starvation during the great famine of 1876-77. There were no sales of Kanara timber at Haliyal during those years, and the effects of this famine period influenced adversely the value of timber for a

long time afterwards. Of late, however, the price of teak has greatly advanced. Several of the large Railway Companies, Great Indian Peninsular, Southern Mahratta, etc., have become large purchasers of Haliyal teak, and as the supply is strictly limited by the conditions of the working plan, the increased demand for a limited quantity of material has considerably enhanced the market rate of teak.

The differences and merits of the two kinds of teak timber, *viz.*, Malabar or Kanara and Burma or Moulmein, are well known to the readers of the *Indian Forester*. Haliyal was the chief dépôt in Bombay, Western India, for the sale of the former, and as such a notice of its abolition was likely to prove of interest. The future of the new establishment at Tawargatti will be carefully watched by Bombay foresters and others interested in the timber trade of North Kanara.

CORRESPONDENCE.

FIRE PROTECTION AND OTHER MATTERS.

In the number of the *Indian Forester* for May 1904, in the final paragraph of my letter on fire conservancy, I made a statement of fact which was true a dozen years ago, but now admits of some modification. I also used the words "pharisaical attitudes," which I now regret as possibly hurting some feelings and raising anger without producing an equivalent benefit in the result.

Our Department has now to accept the existence of a schism in the form of the "Burma School," upholding as its device the motto that fires are good for teak forests. The new school in the ardour of its novelty goes so far as to say that fire protection is the upstart, and that fires have always been a condition of teak existence and regeneration. This latter assertion I utterly scout, though I can no more prove that fires were not annual a century ago than my opponents can prove the contrary. The school appears really to base its existence on the single observed fact, which it cannot explain, that in some cases more teak seedlings have been found in burnt forests than in unburnt.

To return, I wrote that it would be possible to "walk from Bombay to Surat and Khandesh without finding a single sound teak seedling, and very few young teak seedlings of any kind." I am not sure that the above statement is not still literally true, but never the less, since I last knew this district there has been a marked change which ought to be recorded. The change consists in the fact that there are now plenty of places (in the less populous parts) where teak seedlings of a sort may be found. I do not say sound ones, for most of them show signs of two or three dead shoots, and are consequently in truth coppice shoots already infected with unsoundness. Seedlings that have germinated and become saplings without a hitch are extremely rare, so far as I have yet travelled. The reason of this remarkable change is quite indisputable, and it does not bear out the views of the Burma School. The *deus ex machina* is here simply the Collector!

Of all the matters that strike the eye of the forester in touring these forests, the only matter which is self-luminous and loud is the connection between the state of the forests and their frequentation. Other matters have mostly to be sought for and examined into. This one speaks for itself, and through a megaphone. *The state of the forest is inversely proportional to its frequentation.* Wherever people and cattle swarm the forest conditions are very bad, and seedling regeneration practically absent. The crop is pure teak because everything else has been exterminated. The extermination of the teak itself is only a matter of time unless more effective measures are taken in the interests of regeneration. Even teak forest cannot live on coppice alone. The most retired forests of the ghats have been destroyed by *dalhi* or *kumri* cultivation till there is very little left available for State needs, but what is left is mixed forest with comparatively little teak, and it is here that seedlings of all kinds are to be found. The trees themselves have mostly been hacked or injured by fire, but the conditions are still good because frequentation is less. Nevertheless, even here some of the few blocks reserved are approaching the coast type through cattle-breeding. We have been brought up in the doctrine that oxen are respectable citizens, who

live by munching grass quietly, casting no roving eyes to see what else they may devour. How many of us have yet realised the fact that Indian cattle do not recognise these limitations? *Indian cattle are browsers*, and it is lucky they possess neither the agility nor the enterprise of the goat.

The most offensive forms of frequentation here are fires, grazing and the cutting of *tahal* (or branches, seedlings, bushes, &c.) to burn on the seedbeds for rice. Behold now the intervention of the *deus ex machina*. In former days, as I wrote last May, fires raged throughout with sickening frequency, and those portions of forest that were not burnt once were either bare rock or burnt twice. Recently it has been my privilege to see in various places the grass of last year rotting still on the ground, and to note actually the formation of a vegetable soil on top of the former washed-out mineral. In fact, the fires have received a check. This is in nowise due to the efforts of my colleagues (may they pardon me for saying so) for the Department has always done its utmost. It is simply due to the Collector. For the last dozen years or so there has been an officer who has worked very hard and very honestly, and has succeeded in convincing his subordinates that he means it. To him is due the whole credit of diminished fires.

For diminished general grazing we have to thank the sad famines of past years. These have rid us of many poor beasts that lived only to convert forests into manure. There is still overgrazing in some places, and in such places the outlook is bad. The administration of the grazing rules, taken out of the hands of the Forest Department and placed in those of the village officers, I am told, has become largely a dead letter. Nevertheless, I believe the grazing in closed *coupes* has diminished, and this again must be placed to the sole credit of the Collector, for this Department has not for many years been allowed a free hand in the suppression of illicit grazing. The destruction of forest by *tahal* cutting has been largely obviated by practically disforesting the forest affected, but there are still important areas of reserved forests where neither shoot nor seedling can establish itself.

Now, the forests where the improvement has taken place have experienced no change of climate or any natural cause to account for it. The only change has been a diminution of grazing and of fires in both closed and open portions. Both these agencies are important, but there can be little doubt that the more important of the two is fire. The result has been a real improvement in regeneration wherever the protection has improved. As the soil improves under protection the regeneration will also improve.

I do not know much about the typical pure teak and bamboo forests where bamboo suppresses the teak, though there is an approximation thereto in the Kanara forests; but I know a good many mixed teak forests both under heavy and light rainfall, and do not think we in Bombay need be in the least fear of teak seedlings being extinguished by shade. I cannot recall a single case of teak seedlings suffering anything more than inconvenience, from shade alone, anywhere north of Belgaum and Dharwar. In Burma and Kanara it may happen, but I must say I am not in accord with the Burma School any more on the question of teak suppression than on that of fires.

F. GLEADOW.

P. S.—I have only just received my *Foresters* for October—December, and have not had time to read them, but note with pleasure that the discussion on fires, &c., is taking a more reasonable course, and is now coming down to what I originally demanded, *viz.*, precise details.

There are one or two points on which I may be permitted to express a cursory opinion *en passant*. The first is the article by "More Light" on proportionate fellings. I am glad to see he goes still further than myself and thinks the method applicable even in half ruined forests, but the suggested procedure appears to me to savour rather of the method of storeyed forest than of proportionate fellings. The next is Mr. Ryan's article on Root Suckers. These are a very common mode of spreading, quite apart from injury, both in Europe and in India, but the species that do so to a profitable extent are less numerous. Among the hardwoods that do so on a commercial scale one of

the most important is *Sissoo*, D. *Sissoo*. Among the underwood *Randia uliginosa* seems to become gregarious through this means. *Populus euphratica* is another instance, as stated by Mr. Ryan, but in Sind this tree is distinctly characteristic of flood waters. It sometimes comes up after a flood like grass. Consequently very many cases supposed to be root-suckers must be simply root-weldings, the mixed roots of independent seedlings having become joined by contact and pressure. I have seen teak plants, apparently suckers, which I should be sorry to state were really suckers for the same reason, but the teak no doubt does throw up suckers. Our real difficulty lies in keeping down fires and cattle trespass. Once this is accomplished there will be no need to trouble about suckers as an aid to regeneration.

My third point is Mr. Ryan's article on Bassia. Mowra seed is quoted commercially in various papers, but that is no reason why we should encourage it. Spoiling the ship for a ha'porth of tar is one thing, but there is a parallel operation, *viz.*, ruining the forests for the half penny. I thoroughly agree with the "certain Collectors and the Commissioner of Customs and Abkari" on the subject, though on different grounds, and should be only too pleased to see the mowra tree exterminated as being the cause of more fires than all its produce is worth. Taken all through, minor produce often means a visible farthing in the hand and an invisible but real damage of a sovereign to the estate.

My last reference is to Mr. Hodgson's article on 'Certain Important Forest Questions,' p. 468. The statements on this page as to germination support my position, but the author is in error in supposing that the existing open forest of pure teak and grass is a natural formation in Thana and Surat. The forest is pure teak because fires, rab, and grazing have killed out everything else. Teak, being a royal tree, has been less hacked, where everything else was cut down annually. The forest is open grass simply because the fires and grazing render regeneration impossible. Under present conditions the reduction of some important areas to complete stony barrenness is only a question of time.

F. G.

THE LIFE OF RAILWAY SLEEPERS IN BURMA.

Some very interesting statistics on the life of railway sleepers in India are published from time to time, and it is often asked why Burma does not contribute. The following incident will show how little interest in the matter is taken by the Burma Railways Company, Limited, which is especially to be deplored seeing that sleepers are exclusively made from *Pyinkado* (*Xylia dolabriformis*) which is now becoming so scarce in most accessible places that *jarra* is being imported. There are doubtless several other suitable woods in Burma, but they must be tested experimentally before being tried on a large scale.

In 1901 sleepers of 12 species were treated by the Haskin Process and handed over free to the Railways Company for experiment. After one year's trial they were taken up for examination with the following result :—

Didu (*Bombax malabaricum*) was completely eaten by white-ants.

In (*Dipterocarpus tuberculatus*), *Kanyin* (*D. laevis*) and *Kusan* (*Hymenodictyon thrysiflorum*) were partly rotted at the ends and underneath.

Yemane (*Gmelina arborea*) was just beginning to be attacked. *Thabye* (*Eugenia* sp.), *Huaw* (*Nauclea cordifolia*) and *Tankkyan* (*Terminalia tomentosa*) were in good condition and *Thilpyu* (*Albiggia odoratissima*) and *Kokko* (*A. lebbek*) showed no signs of wear.

In June 1902 the Railways Company reported that with the exception of *Didu* all the sleepers had been put down again for further experiment.

On the 1st December 1904, in response to further enquiries, they reported that "the sleepers were put in the line in May 1901, and were taken out in May 1902 in a very bad state of decay."

The experiment therefore comes to an abrupt conclusion.

CAMP :

The 21st January 1905.

H. S.

WORKING PLANS.

Whatever may be thought of the other suggestions contained in "X. Y. Z.'s" letter on "Working Plans" in the January number of the *Indian Forester*, the one in which advice is tendered to working plan officers as to the manner in which they should set about their work would seem under the circumstances to be somewhat unconvincing. He says "I have written one working plan myself, but there was little or nothing original in it. I read every plan on similar lines that I could get hold of, and made use of everything in them that I could. In my opinion every working plan officer should do the same." It seems questionable if the more or less hasty assimilation of a vast number of facts about forests one has never seen is of any real assistance. In order to pass an examination or to write an article some such preparation would doubtless be desirable; but the officer in actual charge of the preparation of a working plan would seem to be somewhat differently situated. He has at his back the Conservators and Inspector-General, who have all the facts at their fingers' ends, and who must of necessity, from their much longer and more varied experience, be infinitely more capable of handling them properly than he is himself. May he not then possibly do better without this preliminary excursion round the bookshelves? It seems doubtful also whether the summaries suggested by "X. Y. Z." would be of much assistance, as the facts would be still more indigestible in this form than in their proper places in the original working plans.

6th February 1905.

C. C. HATT.

THE MADRAS FOREST MEMBER'S TOUR IN ANANTAPUR.

Being now in charge of this district, I have read with considerable interest the remarks of your reviewer on the tour of Mr. Sim, I.C.S., and though I agree with many of your conclusions, in two respects I beg entirely to differ.

(1) It is stated that the growth on the hills in this district is now miserable and will never be good. The first part of this premise is true, though in many cases the every-day requirements of the

population are now met; but I very much doubt the accuracy of the second part of the statement. There can be found to-day on the ground stumps of trees which must have been very considerably larger than any trees now in existence. There are also the massive beams of the gallows which have been erected in several places in this district, and which date back approximately to the time of Sir Thomas Munro or to approximately 1820. This was at a time when, apart from the fact that distance rendered it prohibitive to import timber of such size, it was necessary to hang dacoits, for whom the gallows were made, as soon as possible after capture. I am of the opinion that the wood must have been procured locally. Furthermore, according to the "Memoirs of the Geological Survey of India," by W. King, B. A. though there is a decided difference between the formation of the Nallamalais in Kurnool and the hills of this district, yet the difference is not so marked as to prevent the latter from reproducing a timber of a size similar to that which the Nallamalais can and does produce.

I would rather say that the reason why this district is impoverished is due to two causes; the one is overgrazing, the other is bangle kilns. I start with the presumption that these hills for the reasons above stated were covered with forest, but after the introduction of British rule every one began to keep for himself flocks of goats, sheep, and horned cattle which grazed indiscriminately over the hills, which in this district are practically isolated and in close proximity to the villages. This grazing no doubt retarded regeneration. The damage, however, thus caused was small compared with that caused by bangle kilns. In this district there are large areas of "chouder" or saline earth, quite uncultivable but absolutely necessary for the production of bangles; wood is also another essential, and in all sorts of out-of-the-way places it is possible to come across abandoned kilns. Mr. Peet in his inspection of the district in 1888 left it on record that there were, as he ascertained, 93 kilns, of which only 18 were then working. This was for one taluk out of eight, and though I admit there were more kilns there than I have seen in any other taluk, yet further comment is almost unnecessary. The

owners merely stopped working because the supply of wood ceased; the "chouder" will continue until the land is properly reclaimed.

(2) You mention that anything short of an absolutely impassable fence throughout its entire length is practically worthless. To criticise is easy, but it is far more difficult to state a remedy. The reserves in this district are, owing both to their present inferiority and also to the enormous number of scattered hamlets in their close proximity, primarily grazing reserves. It is admitted on all sides that heavy grazing must practically cease, of late years a surplus of from half to two-thirds of a lakh of rupees having been realized from this source. Little or nothing has been spent in improvement of growing stock, and the fence so proposed would not only afford considerable employment but would also spread abroad the fact that the Forest Department is endeavouring to grapple with this question in an enlightened manner.

As regards the low stone walls erected in 1876, why they were put up where they are it is difficult to say; but I should say that they were made simply as the exigencies of the famine demanded. There are many better areas left unwalled, but the walled areas contain, except in one case, considerably better growth than is to be found in the immediately surrounding lands. The walls have, I think, justified their existence, and they are to-day practically intact; nothing that we can build will keep out a man who intends to get in, but what is built may even though interrupted have a moral effect. The ryots of this country, as in the case of the farmers at home, surround their fields with a fence. Nobody could pretend that such a fence is absolutely impassable, and yet I would venture to say that such fences do have their moral effect. I often remained the right side of the fence at home simply because I did not know if I could get back fast enough to my gap when an infuriated farmer hove in sight.

There were also, so far as I can gather, no reserves in this district prior to 1883; that is, shortly after the arrival of Sir Dietrich Brandis. Before that period there were only a few topes in charge of the jungle conservancy. I would also mention that the idea for

this district of live fences, which of course have to be started behind a fence of thick dead thorn, did not originate with me but with Mr. A. W. Lushington, the then Conservator, and we are today only experimenting with a theory proposed by Sir Dietrich Brandis over twenty years ago and which according to his "Suggestions regarding Forest Administration in the Madras Presidency" (page 168) has succeeded well in Ajmer. Euphorbin tortalis, E. antiquorum, and E. trigona are exceedingly common in this district, and is it to be held at once without experiment that the proposals of Sir Dietrich Brandis are too Utopian?

ANANTAPUR :

B. H. BARLOW-POOLE.

28th February 1905.

REVIEWS AND TRANSLATIONS.

FOREST ADMINISTRATION REPORT OF THE N.W. FRONTIER PROVINCE, 1903-04.

The Annual Report of the Hazara Reserved Forests is this year usefully supplemented by a brief interesting note on the management of the Village forests drawn up by the Deputy Commissioner. To this report we propose to allude later on.

During the last few years the entire management of the Reserved and Village forests in its bearing on the agricultural population has come under review in connection with the current settlement operations, and practically all the questions which had been the subject of acute and lengthy controversy since the first Hazara Forest Regulation was passed in 1873 have been disposed of. Within the past year orders have been passed regarding the redemarcation of the remaining two ranges, Khanpur and Dungagali, and all that now remains is to complete the Forest Survey and secure agreement between the Forest and the Village maps.

Working plans for the Khanpur, Siran and Dungagali ranges are now being prepared by the Divisional Officer in addition to his other duties, and when these have been completed all the

forests will be under systematic plans of working. The provisions of the Kangar Working Plan were in the main carried out, considerable progress being made towards clearing off the arrears of prescriptions. Deodar seed was again very scarce, however, for the third year in succession, and little could be effected in the way of the prescribed cultural operations.

Owing to the inadequacy of the staff not much progress is at present being made with road making and repairs, but it is satisfactory to note that houses are being erected for the subordinate staff, more especially in the hills.

There is a most satisfactory decrease in the area fired over (2,902 acres as against 6,112 in 1902-03), and this is attributed to the prompt action taken by the Deputy Commissioner in enquiring into cases and to enforcing village responsibility where the fires, as is usually the case, are incendiary. It appears that in these forests the fires are not only lit in the first instance by the villagers but are *kept alight*, and the people who attend nominally to put out the fire spread it by lighting the forest in other directions. With such a state of affairs the recognition on the part of the Chief Commissioner of the energetic action taken by the Civil Authorities to put an end to this practice cannot but have the best results on this important part of the management of the Forest Estate.

The experiment of regulated firing was tried in Deodar in certain village forests under the direct supervision of the Deputy Commissioner. The areas were subsequently inspected by the Conservator, who was of opinion that the treatment was not conducive to the continuance of the forests as tree-bearing areas, and moreover that the young grass, which sprouted after the fire, was entirely spoiled in many places by the fall of needles (the forests consist of *Pinus longifolia*) which is much heavier in burnt than in unburnt areas. The Chief Commissioner is however not yet satisfied that the experiment has had a sufficient trial, and the Deputy Commissioner was instructed to proceed with it in selected areas the following cold weather. It will be interesting to hear the result of this measure.

Transplanting operations of deodar seedlings apparently failed through insufficient staff and owing to a hot and dry autumn.

The felling and lopping of blue pine and other inferior species dominating deodar was carried out during the year. The Divisional Officer recognises that much damage may be done through ignorance in this operation, and therefore himself sounds the warning note. We would suggest that the operation is one which should not be followed blindly, as it appears that the benefits which accrue are not always as advantageous as was previously supposed. That the operation in the case of blue pine, spruce, &c., undoubtedly leads to a very considerable increase in the numbers of certain bark-boring beetles (*Scolytidae*) in the N.-W. Himalayas is not open to doubt, and it has become apparent that some of these will attack the deodar under certain conditions.

The produce of the forests is extracted by departmental agency and also by the sale of standing trees to purchasers, the amounts of timber removed being approximately divided between the two. The total timber extracted including free grantees amounted to 945,716 cub. ft. Fuel is nearly all removed by purchasers, the amount rising from 189,000 cwt. ft. in 1902-03 to 417,000 during the year under report.

The income of the year showed a rise, the figures being the highest on record, as is carefully pointed out in the Resolution on the Report.

	Revenue.	Expenditure.	Surplus.
	Rs.	Rs.	Rs.
1902-03	... 99,148	56,034	43,114
1903-04	... 1,00,940	64,188	36,752

We quote the following from the Chief Commissioner's Resolution :—

"The statistics show that there is a steady and substantial increase in the amount of timber and fuel extracted from the forests,and there is reason to believe this will be maintained. It is therefore the more necessary to make timely provision to meet the increasing demand by improvement of the road and river

communications, and the Chief Commissioner trusts that more will be done in this direction.....

"There will probably be no difficulty in obtaining the necessary funds if the financial results are more clearly exhibited."

The Chief Commissioner recognises that Mr. Monro's duties have greatly increased, and further temporary establishment has been sanctioned. It is trusted that this will be made permanent.

In his brief report on the Village Forests the Deputy Commissioner points out that the new rules having only recently come into force, it is impossible as yet to make any statements with reference to their working. The main result would seem to have been to stop the sale of timber and considerably reduce the sale of firewood from guzaras. This is undoubtedly to the advantage of the people, and there are some signs that they are beginning to recognise the fact. The indirect result has been to throw more work on the Department and to increase the demand for timber and fuel. The general policy of the new rules appears to be to save the Village Forests from the rapid denudation which was overtaking them. To still further this object the question of imposing a tax on sheep and goats has been raised, and will be considered during the year. As reproduction is impossible of attainment with flocks of these animals roaming over the forests, we trust that this step will be taken. Bostan Khan, Naib Tehsildar, who is assistant in charge of the Village Forests under the Deputy Commissioner, gave complete satisfaction.



THE TOPOGRAPHY OF BRITISH INDIA.

India. By Col. Sir T. H. Holdich, K.C.M.G., K.C.I.E., C.B., R.E. With eight coloured maps. *The Regions of the World.* Edited by H. J. Mackinder (London : Henry Frowde, Oxford University Press. Price 7s. 6d. net).

Sir Thomas Holdich is too well known in India to render any introduction of the author of this book necessary. The work forms one of a series entitled *The Regions of the World*, edited by

Mr. Mackinder; of which *Britain and the British Isles*, *Central Europe*, *The Nearer East*, and *North America* have already appeared. *The Far East*, which should prove of as great interest to Anglo-Indians as the volume under review, is in the press.

In his short preface Colonel Holdich informs us that he was carefully warned against the inclusion of statistics and details, and he has therefore chiefly relied on descriptive methods of treating the infinite variety of the geographical configuration and the geographical distributions of India. British India and Burma together occupy 905,000 square miles of the Continent of Asia and the Native States and Dependencies of India absorb 611,000 more. This is exclusive of Baluchistan (130,000 square miles). The total population of this area amounted to 231,000,000 by the census of 1901, or about 15 per cent of the entire population of the world.

With climates varying from the ice-bound deserts of the higher Himalayas and the rain-steeped forests of Tenasserim to the barren desolation of Makran, where at one time of the year fire is almost unnecessary, even for cooking, and at another the cold blasts almost render human habitation impossible ; with inhabitants who number races unsurpassed as brave and fierce fighters and races among whom cowardice is regarded as no disgrace ; with customs, laws, literature and arts essentially at variance with Western notions in these matters — such is India, a name merely or rather a geographical expression for the territories administered by the Indian Government. To describe such a country within the limits of a book of moderate compass required a masterhand, and such has been found in the author.

The Indian Empire is composed of two parts, each of which may be regarded as a geographical unit, and each geographically distinct from the other. The larger and more important of the two may be regarded as India proper, and consists of the alluvial plains of the Indo-Gangetic river system and the triangular area known as the Peninsula. It is cut off from Burma by a tract of mountains impassable by reason of the deep-cut network of

valleys and the dense vegetation with which their slopes are covered, and on the north it is bounded by the mighty range of the Himalayas. Both these barriers have proved effective against either ethnical or military invasion, but on the west are the semi-desert hills and open plains of Afghanistan and Baluchistan, which have been repeatedly traversed by invaders. It was across this region that came, not only the great prehistoric Dravidian and the semi-historic Aryan invasions of India, but also the military invasions of Alexander the Great and of the successive Mahomedan conquerors of India. Until the improvement of navigation brought in the nations of the West it was the only route by which invasion and conquest was possible.

The historical invasions from Alexander downwards have been purely military : they have left their impress more or less deeply marked on the religion, the administration and political geography of India in buildings and public works, but they have hardly affected the great bulk of the people who derive their origin from the earlier invasions.

The other unit of the Indian Empire is Burma, which belongs geographically rather to Indo-China than to India. Cut off from the latter by a band of forest-clad mountains, which has rarely been traversed, it received centuries ago its religion and philosophy from India, but has remained unaffected in all other respects, and maintained its ethnical distinction untouched. This isolation is now at an end, and the gay, picturesque, pleasure-loving Burman, who had evolved an epicurian philosophy and regarded life merely as something to be enjoyed, is being ousted by the plodding unattractive native of Bengal and Madras.

Across the north of the Empire runs the great mountain barrier of the Himalayas, the highest and greatest mountain range in the world, which separates the Mongolians of Tibet from the races of India, and has left its impress on their mythology and folklore. This is given a chapter to itself, but the author abstains from formulating any theory of the Himalayas.

On the subject of Afghanistan it is worthy of note that the author consider, that the country will in the future have to look to

its forests and resources in silk, camel-hair clothing and wool for further financial development, since every available acre is already cultivated. We trust, should this be the case, that the Amir will be guided in the management of his forests by the opinions of trained experts rather than by those of the lumberer, for the advent of the latter into a country like Afghanistan would be disastrous.

To all interested in the study of the Fauna and Flora of India or in its geographical peculiarities we can confidently recommend this fascinating book, perhaps not the least interesting portions of which are its excellent maps.

A TURPENTINE CONCESSION IN BRITISH HONDURAS.

A correspondent has very kindly forwarded the following translation of a note in the *Revue des Eaux et Forêts* of 15th February 1905, which is itself a translation from the English *Board of Trade Journal*:—

British Honduras—Concession of Turpentine.—According to an agreement between the Governor of British Honduras and an American this latter, in return for the privilege of collecting the turpentine of 12,500,000 pines, engages to pay one cent per pine. For the concession, which is granted for 26 years, 125,000 dollars are to be paid within two years from now.

According to the terms of the agreement all the products of the pines obtained by the grantee will be exempted from all export dues, and the material and tools necessary for cutting or tapping the pines and for the manufacture and transport of the products of the pines will be admitted free from importation dues.

On this subject the United States Consul at Belize reports that the exploitation of the pine forests of British Honduras will necessitate large purchases of machinery and of food for several years. Nearly one-third of the Colony is covered with pines, and, although the trees are not of large size, the wood is very hard and rich in sap.

The concession has been given especially with a view to the manufacture of the turpentine and to the exportation of the timber, but the industries (*entreprises*) which it will develop as a consequence will not be limited to these projects alone.

Tramways, permanent roads, and the development of agriculture will certainly follow, and the utilisation of the unexplored lands of the Colony will be effected, or at least greatly encouraged.

The writer in the *Revue des Eaux et Forêts* adds the following remark of his own :—

The Governor of British Honduras appears to us to have chosen a rapid and certain method of ruining the forests and the Colony.

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

TWO NEW INDIAN RUMINANTS.

SPORTSMEN will be interested to learn that two important additions have recently been made to the big game fauna of the Indian Empire. A short time ago that well-known Burmese sportsman, Captain Evans of the Veterinary Department, sent home to the British Museum the skins of two gorals from the interior of Upper Burma, which, on examination, proved to indicate a perfectly distinct species. For this species an appropriate name has been selected. That the Burmese goral would turn out to be an undescribed form has long been expected, but the one specimen previously received in England was insufficient to determine this point with any approach to certainty. The animal is a brownish grey species, without any distinct dark dorsal stripe or dark streak down the front of the legs, and with a yellowish throat-patch. While examining the skins of Himalayan gorals in the collection of the British Museum for the purpose of determining the Burmese species, an altogether surprising and totally unexpected discovery was made, namely, that there are two

perfectly distinct kinds of goral in the Himalayas. In several books on Himalayan sport, such as the late General McIntyre's "Hindu-Koh," the Himalayan goral is described as a grey animal with a large white patch on the throat and sides of the face; and an animal of this type, from Chamba, is now living in the London Zoological Gardens, where it is labelled as being the true goral, *Urotragus* (or *Cemas*) *goral*. A similar specimen, presented by the Duke of Bedford, is exhibited in the British Museum.

On turning, however, to Blanford's "Mammals of British-India," we find the goral described as a brownish ruminant (with a tendency to grey) characterised by the presence of distinct blackish dorsal stripe and of dark stripes down the front of the legs, as well as by the possession of a white throat-patch. Skins collected by Brian Hodgson in the Nepal district agree in all respects with this description. One example in the same series (in the British Museum) is, however, of the above mentioned grey type, and has apparently been regarded as indicating a colour-phase or immature example of the typical species. It was probably this specimen which induced Dr. Blanford to state that the ordinary Himalayan goral exhibits a tendency to greyness.

The grey goral, as the new species may be called, differs from the typical brown goral not only by its light grey colour mingled with black, but by the circumstance that the pure white patch on the throat extends on to the sides of the face, by the absence of a distinct dorsal stripe, and by the forelegs having a dark kneecap, but being elsewhere of the same hue as the body, instead of with a continuous dark stripe down the entire front surface.

The Chamba specimen living in the London Zoological Gardens, together with the mention of grey as the colour of the animal by General McIntyre, indicates that the grey goral is the representative of the genus in the Western Himalayas. The brown, or typical, goral, on the other hand, as indicated by the specimens collected by Brian Hodgson in Nepal, is doubtless a native of the damper and hotter districts of the Eastern Himalayas; animals inhabiting countries of the latter type being

generally of a darker tone of colour than their relatives from drier, cooler, and more open districts.

Information as to the precise ranges of these two Himalayan gorals is, however, much needed ; and this can be supplied only by sportsmen and collectors in India. The occurrence of a specimen of the grey goral in the Hodgson collection may probably be taken as an indication that this species (as well as the brown goral) is found in some part of Nepal or the adjacent districts of the Himalayas. Possibly the brown species may inhabit the damp Terai area, while the grey species is confined to the drier zone immediately above. It has, however, still to be determined whether the brown goral is really a forest species, for in Chamba and Kashmir goral are, I believe, found in grass country dotted over with low bushes rather than in forest. The matter may be commended to the best attention of sportsmen, more especially those who have the opportunity of shooting in the Terai district. A good skin of the brown goral would be very welcome at the British Museum for exhibition purposes. Captain Evans is to be congratulated on obtaining the specimens which led incidentally to the addition of two species to the Indo-Burmese fauna.

R. LYDEKKER, in the *Indian Field*.

THE CLOSE SEASON FOR JUNGLE HENS IN THE NILGIRIS.*

The Committee of the Nilgiri Game Association recently approached the Revenue Board with a proposal that the close season for jungle hens, which at present commences on 1st January, should in future beg in on the 15th December. The alteration was recommended because it has been found by experience that jungle fowl begin breeding before the end of December and that considerable damage is caused by the shooting of hens during the latter half of that month. For the reason stated the proposed

* From papers kindly placed at the disposal of the Hon. Editor by the Government of Fort St. George.

alteration was recommended. The Board after a consideration of the case supported the Game Association's proposal, the Government being asked to substitute 15th December for the 1st January in Rule 3 of the Nilgiri Game Rules.

In their reply Government stated that they were unwilling to accept the proposal of the Nilgiri Game Association, which would involve the prohibiting of the shooting of jungle fowl during the Christmas holidays, and created a close season of nine months throughout the whole of the Nilgiris. In their decision they quoted chapter and verse from Blanford (*Faun. Br. Ind. Birds*, iv, 85) "the time of breeding (for jungle fowl) varies : March and April on the Eastern side of the Nilgiris, October to December on the Western, but generally from March to July." This would make the proposed open season the breeding time as far as the Western Nilgiris are concerned.

The Board was requested to ask the Game Association to consider the question further and to report whether a shorter and different close season should not be prescribed for the two sides of the district.

It seems a pity that the Game Association did not reply direct to this question of Government, for it would have afforded some very interesting practical information. No one, and we are sure Dr. Blandford would himself be the very last, pretends that we understand all about the habits of the greater number of our game birds in India, and here we have a case in point, for there appears to be a considerable divergence of opinion as to the breeding season of even such a familiar game bird as the jungle fowl. The Game Association replied as follows to the Government question :—

The Committee beg to point out that the proposal does not involve the prohibition of shooting *jungle fowl*, but only of jungle hens, which require special protection during this period. Jungle cocks can be shot up to the 15th March.

The experience of a large number of the Committee is that the breeding season of jungle fowl throughout the Nilgiris does commence before the end of December and continues during the

spring months. The Committee again recommend the proposed alteration.

The Board again referred the matter to the Association for an answer to the Government question, and obtained the opinion that 'there should not be a different close season for the two sides of the district nor does it consider that the breeding season begins in October in any part of the district.'

The Government reply was that it did not see any sufficient reason for altering the existing close season. We regret that in the interests of the bird the Game Association did not take the trouble to substantiate their case. To merely make a statement without bringing forward a particle of evidence, especially when the case is one easily ascertainable and of interest to sportsman, naturalist and scientist alike, is scarcely the procedure one would look for from an enlightened body such as the Nilgiri Game Association. We trust that it will endeavour to impress in a more satisfactory manner upon its members the fact that the bird does commence breeding in the latter part of December, and that the hens are consequently no longer 'game.'

EXTRACTS FROM OFFICIAL PAPERS.

A FOREST TRAINING SCHOOL IN MADRAS.*

IT was suggested in Madras some years back that a school should be established at some central place for the training of the lower subordinates of the Forest Department. This proposal was made by Mr. Gass, Conservator of Forests, Southern Circle. In 1902 Mr. Gass again strongly urged the necessity of establishing a school in the Presidency for the training of Deputy Rangers, Foresters and Guards, and proposed that the school should be located at Coimbatore. The Board recognised the importance of elaborating a scheme for instructing Forest subordinates in special forest works and for instilling into them a greater pride and interest

* From papers courteously placed at the disposal of the Hon. Editor.

in their profession. It accordingly requested the Conservators to consider and settle the preliminary question as to what class or classes of subordinates are most in need of the improvement which such a training would afford.

After consideration of the Conservators' replies to this reference, the Board accepted their unanimous opinion that the training should be confined mainly to Guards and Foresters, but since it was impossible to expect men of the class from which Guards are appointed to voluntarily proceed for their education to a central school, established at a distance from their homes, the Board considered it advisable that one or two schools should be instituted in each circle instead of one for the whole Presidency as suggested by Mr. Gass. Proposals were accordingly called for as to sites, teaching staff, curriculum of studies, etc., for the proposed schools. These replies were carefully considered by the Board and were also discussed individually with the Conservators, and the conclusion was arrived at that one school for the training of Guards and Foresters should be established as an initial experiment in each circle on the following lines :—

- (1) The training to be in the vernacular and confined to practical field work.
- (2) The number of men to be trained not to exceed 20 or 25 for each circle.
- (3) Two courses of training of three months each to be instituted, one more advanced than the other, to be taken successively with an interval of a year between.
- (4) The instruction to be given by an officer by example as well as precept.
- (5) The Instructors to consist of an Extra Assistant Conservator and a Ranger or a Ranger and Deputy Ranger.
- (6) There should be three separate classes in each school, one for Guards (easy), one for Guards (advanced) and a third for Foresters.
- (7) The instruction to be entirely in the forest.
- (8) The Guards to be given a small addition of pay when they have satisfactorily passed through the two classes.

The Board in submitting these proposals laid particular stress upon the fact that a better trained set of Forest Guards and Foresters would be urgently needed if the works of improvement and exploitation which the Department must shortly undertake as forest organisation develops are to be successfully carried out. It would also be necessary to provide promotion for such men as an inducement for them to work hard and be honest. With this object the Board considered that in accordance with the opinions expressed by the Conservators, Foresters should be recruited mainly from the class of Guards ; while the Guards should be recruited mainly, but not entirely, from the local jungle or village class who are accustomed to rough outdoor life, and not from the class of semi-educated sedentary towns men who are not accustomed to such life, and who frequently take up such appointments merely because of their unauthorised emoluments. Guards and Foresters should be men who can really be trusted to do the work expected of them and to carry out the orders issued, not men who have their heads full of undigested and theoretical book knowledge and are incapable of doing practical work. For the above reasons the Board was strongly of opinion that a practical outdoor course of training in forest works (as distinguished from a school course) should be prescribed for Foresters and Guards in order to fit them for their duties.

After calling for further information as to the probable cost of the scheme and to the nature of the instruction it was proposed to impart to the men the Government issued orders in the matter. They recognised that in spite of the severe disciplinary measures (what these were, why needed or how they were to improve the staff is not stated) adopted in late years, the efficiency of the protective staff of the Department still left much to be desired, and they agreed with the Board that with the completion of the process of afforestation better men will be required to carry out the more specialised work. Whilst welcoming the proposal they however doubted whether the general education of the class of men from whom Forest Guards are recruited is sufficient to enable them to profit by the instruction which it is proposed to impart at the training

school; and they therefore consider that it would be advisable to exclude Guards from the scheme. The Department must look to the Ranger, Deputy Rangers and Foresters to get work from the Guards and keep them in discipline. On the other hand the class of Deputy Rangers, as at present constituted, includes many men with little training to fit them for the duties of their appointment; and it would be very desirable that such as have not had the benefit of training in the Forest School at Dehra Dun, nor are ever likely to be deputed there for want of the requisite qualifications, should undergo the proposed course of instruction along with the Foresters, unless they are over an age to be taught or are otherwise unfit.

Proceeding on the above basis the Government modify the scheme as indicated by the Board as follows :—

(1) There should be only one school, situated in some suitable central site in the neighbourhood of typical educational forests.

(2) The school to be conducted by an Extra Assistant Conservator of Forests assisted by a Ranger, subject to the orders of the Conservator of Forests.

(3) The school to be open to Deputy Rangers and Foresters and at their own expense to candidates selected for these appointments. Thirty-five years to be the limit of age. Subordinates holding the Dehra Dun certificate or who are likely to go there not to go to the local school.

(4) Course of instruction to extend over six months and two courses to be held in the year. There to be only one class consisting of ordinarily not more than twenty pupils.

(5) The curriculum to include—Elementary surveying, demarcation, fire protection, supervision and execution of works, elementary sylviculture, drill and care of uniform. No attempts to be made to teach botany or any of the scientific aspects of forestry nor anything not common to the whole Presidency. Finally, the teaching to be in English.

Provision was made for starting the school from the beginning of the next official year (April 1905).

Whilst we are of opinion that the idea of the local school is a most excellent one we regret that the Government should have so modified the Board's original proposals as to greatly decrease the power for good of the new departure. Looking back we see that the original proposal was that the training should be given to Guards and Foresters. They come at the bottom of the Provincial Establishment. At the other end we have the Extra Deputy, Extra Assistant and the Ranger. Their training is provided for at the Dehra Dun Forest School. This leaves in between the Deputy Ranger. It is open to all these latter to go to Dehra, and it may be taken for granted that all the good men will, and do, do so. What is left? It is to teach the residue that the Board's enlightened attempts to improve the lower ranks have been upset. It cannot be advanced that these Deputy Rangers are prevented from attending the vernacular class at Dehra owing to a want of knowledge of Hindustani since the present proposal institutes English as the language of the new school. It is not therefore to teach the non-English-speaking Deputy Rangers, and in Madras these in all probability do not exist. We think that the deputation of these Deputy Rangers to attend the Foresters class at the Board's proposed school would have fully met the case. We cannot agree that the idea of educating the Forest Guards is an impossible one. The training proposed was an eminently practical one, and the sooner a Guard who could not have followed it was got rid of the better for the Department. It is considered quite possible to teach the ryot improved methods of agriculture and the use of better implements. Equally possible is it to teach the Forest Guard a practical knowledge of the work he is required to do, and his use in the forest would be increased thereby a hundredfold. Most Divisional Officers could tell how quickly their own personal peons, Ranger's peons, &c., pick up the forest work. The great essential is that they should be *shown* how to do things.

The Government's decision to constitute one central school instead of three we are inclined to agree with. Experience has always to be gained in these matters, and it is better to make mistakes in one rather than in three places at once. We would

suggest however that the Extra Assistant Conservator in charge should be placed under the Divisional Forest Officer of the division in which the school is located, the latter being directly responsible to the Conservator, since a number of questions and references, etc., will quickly crop up which will require a mature experience to decide upon.

As regards the curriculum the practical course in the forests would have been more useful. The present one has every appearance of being a poor modified adaptation of a portion of the Dehra School course and, in the time available, it could be little else. Contrary to the Board's proposals we should have advocated a six months' course to be spent entirely on practical work in the forest with a practical examination at the end of it. We do not think that the written certificate of the officer in charge would be quite a sufficient guarantee that a student had really assimilated what he had been taught.

MISCELLANEA.

DR. SCHLICH'S LECTURES ON FORESTRY AT THE ROYAL INSTITUTION.*

Dr. Schlich gave two lectures at the Royal Institution on February 2nd and 9th, the following being a short abstract of their contents.

The first lecture was on "Forestry in the British Empire." An account was given of the splendid results of forest management in India. Timber traders forty years ago were as anxious to work out unrestrictedly the splendid teak forests of Burma as they are now to have a free hand in the forests of Canada and Australia, but the wise statesmanship of Lord Dalhousie, acting under the advice of Dr. Brandis, prevented this by reserving the best teak

* W. R. Fisher, B.A., in the Land Agents Record.

forest in Lower Burma for State management, and since the conquest of Upper Burma, all the best forests in the whole of Burma have been gradually brought under State control, so that out of 66·3 per cent of forests under departmental management, there are now 18,000 square miles of finally settled reserves in that country. There were, in 1900, 81,124 square miles of reserved forests in British India, 8,845 square miles of protected forests, and 27,679 miles of forest still left as waste land, and this enormous area is managed by a superior controlling staff of 213 officers, most of whom have been trained at Cooper's Hill, 112 controlling officers of the Provincial Service, trained at the Dehra Dun Forest School in India, 437 rangers, also trained for the most part at Dehra Dun, and 9,759 foresters and forest guards—making a total staff of 10,508 forest officials in the Imperial Service. Besides the forests under State control, there are properly organised forest departments in all the principal Native States, which still comprise about one-third of the area of India, and wherein much progress in forestry is being made.

The area of forests in British India that is protected against fires is now 36,651 square miles, while 33,264 square miles are under working plans.

The gross revenue for the year ending March 31st, 1903, for the Indian State Forests was £1,298,103, calculated at 1s. 4d. per rupee, being £52,265 in excess of the average revenue for the last five years, while produce to the value of about one-sixth of this gross revenue was given free to the natives of villages bordering on the forests. The total expenditure for the same year was £749,956.

Besides the direct benefits to India resulting from the protection and improvement of her forests, twenty officers from the Imperial and Provincial Services were lent for foreign service during the year under consideration—in Ceylon, the Soudan, South Africa, Malay States, South Nigeria, Siam, Trinidad, Mauritius, etc.; while the application for others even by the Native States of India had to be refused owing to the shorthandedness of the staff.

Of other British possessions, Dr. Schlich stated that Ceylon and South Africa alone, and especially the Cape Colony, is properly managing its forests, wholesale destruction of forests without any corresponding protection proceeding in Australia and in Canada. While the splendid eucalyptus forests of Australia are being devastated, feeble attempts at planting new areas are being made at enormous relative cost. The only satisfactory method, of at once selecting large areas of reserved forests, constituting a proper forest staff to manage them, regenerating them chiefly by natural seedlings and cutting annually only the annual increment of the growing woods, has not been adopted. In fact, Australia imports more wood than it exports, while, independently of internal demands for timber, the maintenance of its forests, which are chiefly along the coasts, is required for climatic reasons.

In Canada, in spite of the still enormous areas of forests, waste and destruction still predominate. The forests of Weymouth pine are practically ruined, and the chief exports are now of spruce from the Eastern territories and of Douglas-fir from the West. A series of slides showed the magnificent Douglasfir forests in their natural condition, the construction of a skidway for removing the logs, and the final ruined condition of the forest, after the lumberers have extracted the best of the timber. The damage done to forests in Canada by fires annually is incalculable. Considering that the Dominion obtains a revenue of about £700,000 annually from its forests, it is now surely time to set apart at least half of this for protecting what is left, and above all to reserve a very large area as permanent State forest.

A series of slides showed that there is an annual deficit in the timber supply of the Empire, which can practically be met only by the conservation and good management of the Canadian forests. If the Dominion were to adopt the same wise policy that is practised in India, their forests would eventually be in a position to supply the world with timber to the permanent benefit of their own treasury and people.

The second lecture was devoted to forestry in the British Isles. Most of the matter contained in this lecture was extracted from the pamphlets by Dr. Schlich, recently published by Bradbury, Agnew and Co., on "Forestry in the United Kingdom."

The æsthetic side of forestry was first discussed, and its importance for the formation of game coverts and for shelter to crops and cattle against gales. It was stated that deer bred in real woodlands have much finer antlers, and are in much better condition, than the Highland deer, which roam over immense tracts of heather, and that the rearing of pheasants is quite in accord with good forestry. The maintenance of rabbits was, however, said to be incompatible with that of woodlands.

The status of the proprietors of our forests was also discussed; the State in Britain manages only $2\frac{1}{2}$ per cent. of our three million acres of woodland, which is only 4 per cent. of our total area, less than in any other European country. Land is cheap in Ireland and in Wales, where Mr. A. D. Webster states that about 7,410 acres have recently been sold for £15,670, tithe and land tax free. Here it would certainly be good policy for the State to acquire wasteland and plant it. Half a mile away is growing a heavy crop of larch on similar land, and similar plantations that were cut down have paid 22s. per acre for about sixty years. Municipalities are doing something, as Liverpool and Birmingham are planting the catchment basins of their water-works, and this wise policy might be followed by other towns.

The uncertainty of our future supplies of timber was demonstrated, as there is a net annual deficiency in Europe of 2,620,000 tons of timber. Sweden and Norway are said to be felling more than the normal annual yield of their forests, while, although Russia and Finland still possess large wooded areas, the economic development of Russia promises ere long to require most of the timber it produces. The Siberian forests are very remote, and of very slow growth, and are being rapidly destroyed by fire by the increasing peasantry of that country.

The timber deficit of Europe is now supplied chiefly by Canada and the United States, but the increasing population of those countries and the defective management of their forests show that future Transatlantic supplies are of doubtful continuance. It is, therefore, surely time for the United Kingdom to reafforest large areas of its wastelands, which in England and Wales amount to 3,600,000 acres, with over 9,000,000 acres in Scotland and nearly 4,000,000 acres in Ireland. Nine million tons of timber, representing a value of £18,000,000, are now annually imported into Britain, which could be grown at home, and for this 6,000,000 acres of our wastelands should be planted.

The members of the English Arboricultural Society will next autumn have an opportunity of seeing how the question of the planting of wastelands has been dealt with in Belgium, where scarcely any land of this description now remains unutilised, and Belgium greatly resembles Britain in climate, so that we could readily follow their example. The strong gales which blew down so much timber in Scotland of late years are equally felt in the forest-clad mountain ranges of the Continent, but there proper measures are taken to secure the woods, and to prevent the fall of prices, when windfalls occur.

As regards the question of the unemployed, there are within reasonable distance of London, in the counties of Surrey, Kent, Sussex, Suffolk, and Norfolk, about 100,000 acres of wasteland. By planting this up, labour would be required during the winter, when agricultural work is slack. In this way, men would be kept in the country, instead of crowding into the towns, and increasing the numbers of the unemployed.

The fact that large compact areas of woodland were established would lead to the establishment of industries using wood as raw material, and would thus tend further to employ labour.

Regarding the question of economic planting by landowners Dr. Schlich had much to say. He rebutted the statement that our timber will always necessarily be inferior to foreign timber. The latter owes its excellence to the method under which it is grown,

as was shown by a number of excellent slides. Dense planting, deferred and light thinnings will produce cylindrical timber, even grained and free from knots, and our climate and soil are at least as suitable as those of North Germany for producing good timber.

The want of reliable statistics regarding the results of home timber-growing was commented upon, and the excellent data to be obtained from German yield tables, the latter being fairly applicable to this country until we have data at home.

Slides were shown, giving the percentage obtainable by crops of larch, oak, Scots pine, and other trees, when planted on land of different values, it being shown that larch would yield $2\frac{1}{2}$ per cent on land worth £45 an acre, and oak $2\frac{1}{2}$ per cent on land worth £10. It was argued that $2\frac{1}{2}$ per cent is a reasonable percentage for timber, as the security is very good, while Consols, which nominally give $2\frac{1}{2}$ per cent, have not proved equally secure. A few years ago they stood at 112, but have since been quoted at $85\frac{1}{2}$ a fall of £26 10s. per cent, representing more than ten years interest.

The question was raised of unfair charges on growing timber, in rates and taxes, and the unfairness of charging rates for exceptional traffic on roads, when a mature crop is harvested, after paying uniform rates for many years, without the owner having utilised the roads. Preferential traffic railway rates for foreign timber also are paid by the landowner, for the timber merchants must allow for the excess freights on home timber, when they buy it, and the effects of this preference has been said to amount to £20 per acre for an average crop of 3,000 cubic feet of mature British timber, in some cases.

Dr. Schlich concluded this lecture by stating that forestry is not entirely based on botany and natural science, but that its financial aspect must be carefully studied, and this must be borne in mind in forestry education.

Dr. Schlich has now been engaged in forest work for about forty years. He did excellent organising work in the Indian forests, between 1866 and 1885, and rose to the position of

Inspector-General of Indian Forests. Since 1885, he has directed the higher forestry education of Cooper's Hill. He has also managed a large forest in Belgium, and has prepared working plans for the Duke of Bedford's woods and for some of the Crown forests. He has visited Ireland, and reported to the Government on the forest question there. He has brought out the "Manual of Forestry," part of which is now in its third edition, and has written pamphlets, and given numerous lectures on forestry, at the Imperial Institute, the Society of Arts, Cirencester, the Royal Institution, Carpenters' Hall, and other places. This country owes him a great debt for the part he has taken in rousing the country to the approaching timber famine, and to the necessity of introducing sound methods of forestry into Britain, and of properly utilising our wastelands, and especially to his exertions in bringing into prominence the economic aspect of forestry. It is to be hoped that he may now be permitted to complete his work by introducing a sound system of forestry instruction to one of our great universities, so that the future rulers of our Colonies, our land agents and landowners, may be able to get sound views of this great question, and a thoroughly competent staff of foresters and forestry instructors may be available. The Cape Colony has already sent its forestry students to an American forest school, and this shows the necessity of a good central school of forestry for the Empire.

DAMAGE DONE BY FIRES IN THE PROME DIVISION, LOWER BURMA.

Mr. J. W. Oliver has very kindly sent us the photograph we show here with the following remarks:—

"View looking into the Bwet Reserve from the boundary fire line.

"Note the damage done to the *Pvinkadu* (*Xylia dolabriformis*) tree, &c, by annual fires before the reserve was protected. The damage done to teak trees is often far greater. I am sorry that I have not a photograph showing such damage."



J. H. Oliver, Photo.

View looking into the Bwet Reserve from the boundary fire line. **a**, *Schleichera trijuga*; **b**, *Homalium tomentosum*; **c**, Young and middle-aged teak in the background; **d**, Probably a *Terminalia*; **e**, *Xyilia dolabriformis* (*Pyrinkedo*) damaged by fire at base; **f**, Probably a *Clerodendron*; undergrowth mostly bamboos.

The other trees depicted in the photograph are (*a*) Schlichera trijuga, (*b*) Homalium tomentosum, (*c*) young and middle-aged teak in the background, (*d*) probably a terminalia, (*f*) probably a clerodendron ; the undergrowth is mostly bamboos and recent seedlings.

This photograph has been reproduced in Schimper's 'Plant Geography.'

EUCALYPTUS SCREENS AS FIRE PROTECTION BELTS.—A correspondent sends us the following extract from a letter received by him from Mr. Wroughton, late Inspector-General of Forests :—

'On my way back from South Africa I stopped at Cape Town where Hutchins showed me his work. He has done very well, and has threshed out the Eucalypts experimentally with the greatest success, and it seems to me that there are infinite possibilities in them for India. He plants Eucalypts, six rows 6' x 6', all round plantations, etc., and in five or six years they form a barrier which no fire can cross, for they kill out all the grass completely, and at the same time prevent burning leaves, etc., being blown across. He says there are Eucalypts to suit every kind of climate.'

This experiment is we think of very considerable interest, and it is not impossible that there are areas in India where these Eucalypt belts could be planted with advantageous results, not the least of which would be the decrease in the fire work of the staff, thus enabling them to give more time to other matters.

A TRIBUTE TO THE MEMORY OF THE LATE HERBERT SLADE.—A "Divisional Officer" sends us the following expression of the estimation in which Herbert Slade was held by his officers in Burma. It comes from one of the oldest and most respected of the Clerical Staff. It is here transcribed word for word : "I regret very much to have to state the death of Mr. H. Slade, our Conservator, and I now feel that you will also feel very painful to hear this sad news of so good and kind hearted a gentleman. I know that we can never find a friend like him any more."

PARA RUBBER.—Much has been written of late upon the Para rubber tree (*Hevea brasiliensis*), its growth, the collecting and curing of the latex, and the diseases attacking the tree. The germination of the seed, however, does not appear to have attracted much attention. Although authorities appear to differ as to the requirements, etc., of the tree, there appears to be no doubt as to the methods of germination, which are as follows:—(1) Sow the seeds direct into pots; (2) make seed beds, and after sowing the seeds, cover them with from two to three inches of soil; or (3) sow at stake, *viz.*, out in the jungle, the scrub being cleared sufficiently to allow the young plant air and light. The general opinion is that the vitality of para seed is short and many failures are put down to this cause. It would appear, however, that the majority of failures are due to the treatment of the seed in its earliest stages. Deep burying of the seeds is a fatal process, as the heavy weight of soil upon the *micropyle* must cause undue exertion upon the *plumule* in forcing its way out; in doing which it is liable to be injured by the extra pressure. The injury thus caused forms a host for fungi which kills the plant in the embryo stage. Again, seeds to be germinated successfully require an even temperature and moisture; it is difficult to regulate the moisture when the seeds are sown three inches deep.

In these gardens we have been in the habit for the last three years of germinating seeds to supply to planters on the Nilgiris. The first year the plan of sowing direct in pots and pans was adopted with very poor results. In the second and third years a system on the plan of a seed-tester was tried. Platforms were erected about three feet from the ground, and on these old sacking was stretched (coir matting would be preferable). Over this was placed a little powdered charcoal to assist in retaining the moisture. The seeds were then placed on this and covered over with more sacking, and the whole kept damp by occasional watering. The seeds were examined every day, and as soon as any showed signs of germinating they were removed and potted off. Seventy-five per cent of a case of seeds received from Peradeniya germinated after this treatment, in spite of being delayed by the Madras

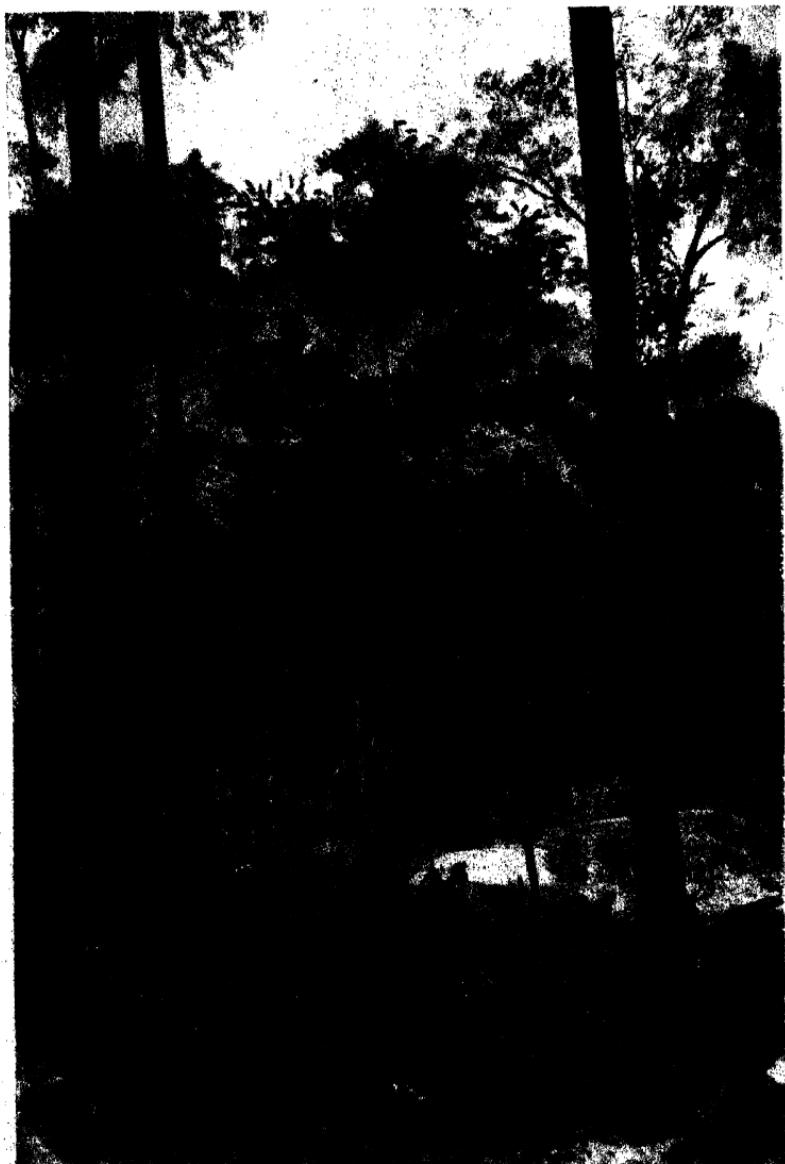
Customs authorities for over three weeks.—*Proc. Madras Hort. Soc., Oct.—Dec. 1904.*

CULTIVATION METHODS IN BURMA.—A large number of the hill people in Burma still adopt the *taungra* system of cultivation burning down a hill side of jungle and planting it with paddy, chillies, cotton, tobacco and vegetables for their own consumption. This spot is deserted after a few years, and another chosen, which goes through the same process. The Commissioner of the Tenasserim division suggested that this wasteful form of cultivation should be discouraged by a gradual enhancement of the rate assessed on each individual or family engaged therein, and the Financial Commissioner is at present conducting an enquiry into the circumstances of the *taungra* cultivators in Lower Burma. The present rate of Rs. 2 per cultivator, or family of cultivators, was fixed over a quarter of a century ago. It was then double the highest existing rate, and high as compared with the prevailing rates assessed on paddy land in the plains. It is not wonderful if it has now become inadequate in certain localities. In the Tevoy district the *taungra* tax produced a larger revenue last year than in the previous year, though there was a decrease of 998 acres under assessment. This was caused by an increase in the tax in 1902.

THE FORESTS OF CHILI.—In that fascinating book ‘The Countries of the King’s Award’ by Sir T. H. Holdich, K. C.M. G., etc., which we can confidently recommend to our readers, we read “Another matter evidently needing attention is the forests. Much of southern Chili is forest clad, and these forests are almost unknown, and their capabilities scarcely explored. Where they can be got at the valuable woods are being rapidly exterminated for want of any system of conservation.”

We should have mentioned perhaps that the book in question is not fiction, but deals with the country lately in dispute between the Argentine and Chilian Governments, which dispute they appealed to the King of England to settle for them.

A THORNLESS CACTUS.—Among the wonderful results of experiments with plant life that have been made by Mr. L. Burbank is the production of a thornless cactus. Mr. Burbank conceived the idea that if the prickles could be eliminated from this desert plant the many arid and waste lands of the States might be covered with fodder for cattle, and some large desert tracts in America are to be sown with the new thornless variety by way of experiment. If it turns out to be a success and the plant does not revert to the original armoured type, the new variety is likely to be as useful to India as the Americans hope it may be to the Western Continent. The Burbank grasses are already recognised as a valuable contribution to agriculture, as he has developed several varieties that will grow on arid plains otherwise devoid of vegetation. The American star-flower, which retains permanently its colour and perfume, the stoneless plum, larger in size than the well-known French plum, a lemon-coloured lily with the perfume of the violet are among the horticultural wonders that this lover of vegetable nature has produced.



H. C. Robinson, Photo.

Palaquium Forest in Federated Malay States in which the undergrowth has been cut back to set free the Palaquium gutta saplings.

INDIAN FORESTER

JUNE, 1905.

THE PROHIBITION OF GRASS BURNING AND ITS EFFECT ON THE GAME OF THE COUNTRY.

"Sahib! you are steadily driving us from our home on these hills. Why is the grass never fired now and why left to die down season after season, till it cumbers the earth with such a mildewed and powdery carpeting as none but the rankest herbage may penetrate when the rain comes down? The bison are going and we follow, and at no distant time these hills will stand yet more desolate, deprived of all that once gladdened their solitude." (Leaves from an Indian Jungle.—*The Autobiography of a Sambar Stag.*)

Some most interesting papers have recently been issued with reference to the former annual burning of the grass on the grazing grounds of the Nilgiri plateau, its recent prohibition, and the resultant effect upon the herbivorous animals of the plateau. The subject in its bearing upon the distribution and preservation of the game, not merely of the herbivora alone but of the carnivora as well, throughout the country is one of considerable interest; but whilst of interest it is also of such importance, alike to the sportsman, the zoologist and the public generally, for the civilised community has set its face against any further extinction, in as far as lays within its power to prevent it, of any of the species at present inhabiting the globe, that its consideration in these pages needs no apology.

PRESENT POSITION IN THE NILGIRIS.

Briefly the position in the Nilgiris is as follows:—The Todas have, from time immemorial, annually fired the grazing grounds of the plateau during the hot weather in order to obtain a crop of fine young grass with the first rains. Apparently as long ago as 1879 the then Commissioner framed rules rendering this practice illegal, but the rules have remained in abeyance until within the last year or so, when they were enforced. This resulted in a petition from the Todas to the Collector, stating

that the prohibition was having a disastrous effect upon their cattle. The matter was then gone thoroughly into, and in order that all parties should have a hearing the District Forest Officer, in his note to the Collector on the subject, suggested that the "Nilgiri Game Association" should be requested to give their views on the question. This suggestion was supported by the Board, and the views thus obtained are of sufficient interest to warrant their further consideration.

IMMEMORIAL CUSTOM OF FIRING GRAZING LANDS IN OTHER PARTS OF INDIA.

As is well known, this firing of grazing areas has been the immemorial custom all over the country, one might almost say throughout the world, wherever the wealth of a community has chiefly reposed in its herds of cattle.

PROHIBITION OF FIRING IN FOREST RESERVES AND OTHER PROTECTED AREAS.

It has become fully recognised that the custom could not be allowed to continue in the great timber reserves of the country nor in those reserves which were required to be kept in trust to supply the daily wants in fuel, grazing and minor produce generally, of the adjacent communities. In these latter all other considerations must necessarily be subordinated to the endeavour to keep the forests in such a condition as shall insure their being able to give a permanent supply of the materials required in the daily life of the neighbouring inhabitants. Firing of all such areas has, in most parts of the country, been strictly prohibited under severe penal laws, enacted entirely in the interests of the community at large. These village reserves, as they may be styled, may or may not be under the Forest Department. In the latter case they may or may not be under fire protection. Excluding the fire protected areas it may be taken as an accepted fact that all other areas occupied by, or in the neighbourhood of, grazing communities are annually burnt. In this latter category may therefore be included—

- (1) The not inconsiderable area of boundary lines, interior fire traces, &c., annually burnt by the Forest Department or Civil

authorities as a protective measure to safeguard the fire protected forests.

(2) The large areas of grass savannahs (called by various names in different parts of the country) annually burnt by the Department with the same object in view.

(3) The annual firing of the majority of non-fire-protected forests and waste lands.

(4) The annual firing (and it may be given a separate heading owing to its vast importance on the question under consideration) of forest and waste lands in the vast majority of the Native States in the country.

RESULT OF THIS FIRING ON THE GRASS.

Now, what is the result of this firing upon the grass? We see in the papers before us that it is held that the grass steadily deteriorates owing to the finer species being killed by the fire and to the manure in the ash being washed away with the first heavy rain! We have read this statement with surprise! Consider for a moment the miles of forest boundary lines burnt every year. Are they not the nightly resort of the herbivorous animals of the adjacent heavy forest and are not the animals seen feeding upon them in the pink of condition and plumpness? Again, the burnt savannahs become full of game as soon as the young grass springs up. In Eastern Bengal the sann (thatching) grass areas are annually burnt over after the grass has been cut with the object of keeping down the growth of the coarser noxious grasses, and thus of obtaining a thick crop of the finer and more valuable thatching grass. Turning to the evidence of the members of the "Nilgiri Game Association," all long residents on the plateau, we see that there is a concensus of opinion against the statement that the grass deteriorates by being burnt. The reasons given by Sir Frederick Price, one of the members, may be taken as the generally expressed opinion of the Game Association on this point—"As regards the theory that burning destroys all the better classes of grass, and leaves only the coarser kinds, it is to be observed—if this is actually the case—that that which is left agrees remarkably well with the Toda buffalo,

whilst that which he gets now evidently does not. I think too much has been made of the point that the manurial constituents of the ashes of the burnt grass are washed away by rain and lost. The principal ingredient of these is potash—a very soluble salt. The rain which comes after the burning has taken place—I speak of this part of the hills including the Kundahs—consists of brief and not really heavy showers, and the surface of the ground after a fire is not smooth. The dry earth drinks the water very rapidly, and very little of the constituents are carried away from the actual spot on which they lie....If this is not so, how comes it that after the grass has been burnt for a series of years beyond the memory of man, burning it still produces at the present time an abundant crop of sweet and green grass? That it does so is beyond denial.

Sir Frederick also alluded to the fact that the annual burning destroys a vast number of insects, such as hairy caterpillars and—that curse of agriculturists—the cockchafer beetle. The latter is to be found egg-laying in the earth at the roots of the grass during the burning season, and thus enormous numbers of beetles, and consequently eggs, are annually killed off.

RESULT OF GRASS FIRING ON THE MAINTENANCE OF THE HEAD OF GAME.

The opinion of all who considered the question of the grass burning on the Nilgiri plateau agreed upon the important point as to its effect on the maintenance of the head of game in the area. The new young grass attracted sambhar and other herbivorous animals to the plateau, and excellent sport was to be obtained as long as the annual burning took place. This of course is the common experience elsewhere in India. The broad fire lines, such as the 100—200 foot lines of the United Provinces Reserves, the burnt over tappas and savannahs, the waste lands all over the country are all haunted by game as soon as the young grass begins to shoot up. The same rule applies to the large areas of grazing grounds in the neighbourhood of big reserves and to the annually burnt over village forests. That this is so is of course fully well known to all Forest Officers who are at the same time sportsmen, and in the interests of the maintenance of the head of game in a district, and

more especially in a heavily shot-over district, they would be the first to advocate the burning of all grass areas where the burning did not actually involve the fire getting into fire protected forests.

**THE EFFECT OF THE PROHIBITION OF GRASS BURNING ON THE
GAME IN THE NILGIRI PLATEAU AND ELSEWHERE.**

The effect upon the head of game on the Nilgiri plateau after the prohibition of the grass firing was enforced became most marked. The Forest Officer alludes to the fact that all the herbivorous animals left the plateau and sought the slopes of the hills which were still burnt over, and where they could therefore find the new young grass coming up after the first rains. This observation is borne out by the members of the "Nilgiri Game Association," who were asked to report on the subject, and by numerous other sportsmen, who have recorded it as an observed fact. It was pointed out that as a result of the two years' non-firing of the grass only seven sambhar head had been set up by the local taxidermist instead of the 25—30 in years past, and further that the deer having left the plateau to go in search of the grass on the lower burnt-over slopes had been killed off in large numbers by the jungly tribes, who all possessed guns, and that consequently the years of good work of the Association had been destroyed.

That sambhar, bison, and other herbivora will not remain in areas where they have been accustomed to find in the neighbourhood burnt-over grass tracts, once fire protection has been introduced on a large scale, is well known to sportsmen, and we should think to most Forest Officers, all over India. The quotation which heads these lines is from the pen of a well-known sportsman and Forest Officer, and the hills he was writing of are in the Central Provinces, famed for its fine shooting grounds. Will they remain so in the future?

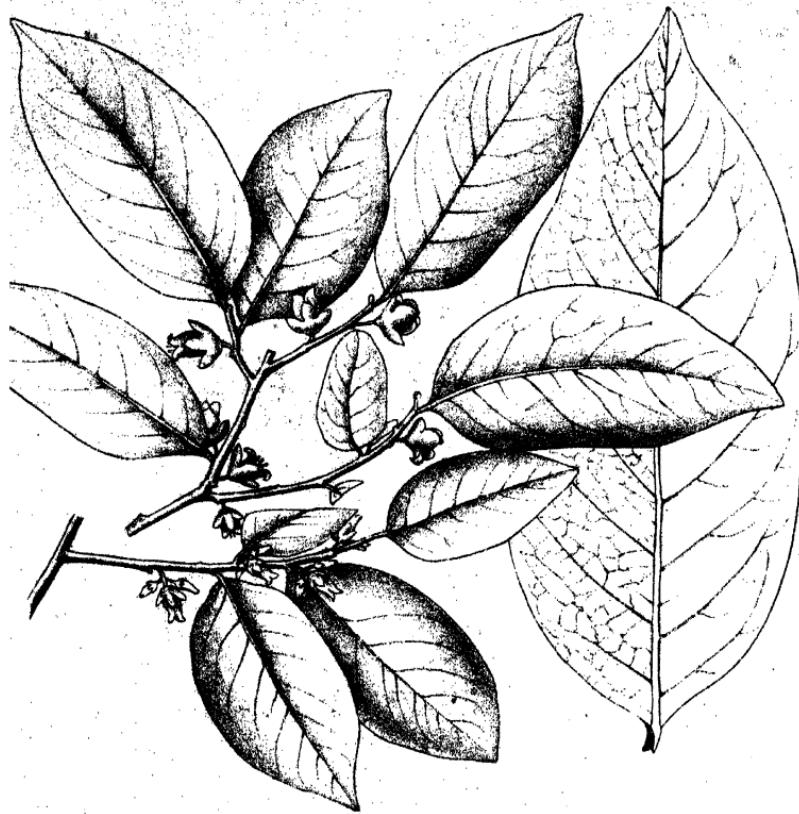
A RESULT TO BE EXPECTED FROM A DECREASE OF THE HERBIVORA.

There is another reason, and a most important one, why it is almost essential that a certain head of herbivorous game should be kept up in the country. We allude to the presence of the larger

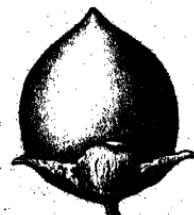
carnivora, who for the most part derive their sustenance from this source. The decrease in the head of herbivorous game in an area must almost of necessity be followed by a large increase in the mortality amongst the cattle of that district, and perhaps not alone amongst cattle but also amongst human life. A tiger will not usually take to cattle killing if he lives in an area where the procuring of a fat young buck is a matter of comparative ease. We write 'usually,' for the tiger's habits in this respect are very variable. It may be taken as certain however that tigers and the lesser carnivora will go to the village herds as soon as any difficulty is experienced in obtaining their more natural prey in the forest. It would, we believe, be by no means difficult to obtain statistics to show that a decrease in the herbivorous game of a district had been followed by a heavy increase in the mortality amongst the cattle of the village communities.

POWER OF THE FOREST OFFICER TO PROTECT THE HEAD OF GAME.

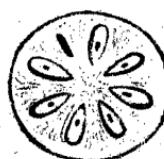
That the first duty of the Forest Officer must be to conserve, in the interests of the community, the protected reserves from fire, even when this means sacrificing the head of game, admits of no criticism and needs no insistence upon in these columns. But we think that it equally falls within the province of his duties to maintain as far as in him lies the head of game in the district in which he serves, and to ever keep before his eyes all available means of carrying out this laudable object. From the very nature of his work he is in the best position for obtaining reports and making himself acquainted with what this head of game roughly is and whether decreasing or increasing. We believe the day will dawn when the Forest Officer will be in a position to keep rough game registers in his office having this object in view, and such registers will be maintained not solely in the interests of the sportsman but equally for the advancement of the zoological knowledge of his district, and *ipso facto* of India as a whole, the habits of much of the game in which are but imperfectly understood.



Flowers



Fruit



Section of Fruit

Section of Flowers

DIOSPYROS KANJILALI, Dubois.

Lith. by S. C. Mondal

SCIENTIFIC PAPERS.

A NEW SPECIES OF DIOSPYROS.

DIOSPYROS KANJILALI, DUTHIE.

Diospyros Kanjilali, n. sp.—A small or medium-sized tree with a fairly long trunk. Bark greenish or ashy-grey and quite smooth like that of the *guava*, exfoliating in thin scales. Branches forming a rather narrow and open crown, not spinescent. Leaves $1\frac{1}{2}$ — $5\frac{1}{2}$ inches long, elliptic to suborbicular, thicker than those of *D. cordifolia*, usually densely tomentose when young, becoming rigidly coriaceous and almost glabrous in age; midrib impressed above, prominent beneath, petioles $\frac{1}{3}$ — $\frac{1}{2}$ inch. MALE flowers in short 3-flowered cymes, pedicels $\frac{1}{6}$ inch; bracts ovate, subacute, ciliate on the margins. Calyx-lobes broad and rounded, pubescent on both sides and with ciliate margins. Corolla $1\frac{2}{5}$ — $1\frac{3}{5}$ inch long, slightly pubescent outside, glabrous within, pale-green. Stamens 16, in opposite pairs, united below; anthers awned, glabrous. FEMALE flowers axillary, solitary, nodding, pedicels about $\frac{1}{4}$ inch. Calyx (in fruit) accrescent; lobes spreading, broader than in *D. cordifolia*. Corolla dark-green, otherwise like that of male. Staminodes 8, alternately longer, the longer ones often toothed near the acuminate apex, the shorter ones obtuse. Fruit up to 1 inch in diameter, globose. Seeds about $\frac{1}{2}$ inch long, somewhat curved.*

Recorded by Kanjilal from Kalsi, Rajpur, Lachiwala and Thano in Dehra Dun, and from Ranipur, Dholkhand and Badshahibagh on the Siwalik range. It flowers during April and May. Other localities are—Chanda district of the Central Provinces,

* I am indebted to my friend Mr. Gamble for the following description of the wood of this species:—

Wood brownish-grey, with occasional iron-grey streaks, soft to moderately hard, no heartwood.

Pores small, very scanty, in radial groups $1\frac{1}{2}$ —3, which are distant between the medullary rays and faintly in échelon. Medull of rays numerous, very fine. Transverse lines very faint.

O 4952. Dehra Dun	50 lbs.
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Duthie No. 9559, N. Kanara, Ritchie No. 972. Mr. Gamble has also collected it in the following localities :—Santal Parganas in Bengal No. 10614, also in the Madras districts of Ganjam No. 13657, Anantapur No. 20873, Bellary No. 16583.

This tree has already been alluded to by Kanjilal on p. 221 of his "Forest Flora," where he remarks—

" There is a tree occasionally met with in the Saharanpur and Dun Divisions * * * which differs from the *montana** as described above in the following respects :—*Trunk* fairly long ; *crown* rather narrow and open ; *branchlets* not spinescent ; *bark* greenish-grey, always smooth, exfoliating in thin scales; *leaves* larger 3—5 by 1½—2 inch, oblong or elliptic, sub-coriaceous, brittle, pubescent or glabrescent, midrib impressed above, prominent beneath * * *."

It appears to occupy a position intermediate between *D. montana* and *D. cordifolia*, agreeing with the former in general habit, stature, smoothness of bark and in the absence of spines but differing by having thick coriaceous leaves, the male flowers in threes (not in panicles) and twice the number of staminodes. From *D. cordifolia* it may easily be distinguished by its smooth bark, absence of spines, the shape of the leaves, the glabrous and awned anthers, and by the number of staminodes ; it also differs by having a more defined trunk with ascending, not spreading branches.

Plate xxx shows the leaves, flowers and fruit of this tree.

I have great pleasure in naming this tree after my friend and former pupil Rai Sahib Upendranath Kanjilal, to whom I am much indebted for a complete set of herbarium specimens and for some excellent photographs of the tree taken by himself.

KEW :

J. F. DUTHIE.

24th March 1905.

* This is *D. cordifolia* Roxburgh and not the true *D. montana* of Roxburgh, which is a comparatively rare tree in Northern India. —(J. F. D.)

ORIGINAL ARTICLES.

SOME FACTS ABOUT GUTTA PERCHA.

BY A. M. BURN MURDOCH, I. F. S.

CONSERVATOR OF FORESTS, FEDERATED MALAY STATES.

Gutta percha, derived almost entirely from trees growing within six or seven degrees of the equator, is naturally one of the most important products of the Federated Malay States, of Perak, Selangor, Pahang and Negri Sembilan. I will endeavour in this article to give a general idea of the subject, under the following heads :—

- I.—General, species, distribution, etc.
- II.—Measures taken for protection, past and present.
- III.—Methods of extraction.
- IV.—Manufacture, adulteration, lines of transit.
- V.—Properties.

I.—GENERAL, ETC.

The word gutta percha is derived from the Malay word "Getah," which means any substance, such as gum, latex, resin, etc., which exudes from wounds or incisions in the bark of trees. "Percha" refers to the Malay name for Sumatra, "Pulau percha." Gutta percha therefore originally meant Getah from Sumatra.

Gutta percha in its pure state may be taken to mean the coagulated latex of trees belonging to the genera *Palaquium*, *Syn* (*Dichopsis*, *Isonandra*) and *Payena*. Inferior gutta perchas are yielded also by several species of *Bassia*, and one or two species of *Ficus*, but these will not be discussed here, the object of this article being to consider the best gutta percha producing species, namely, those above mentioned, which are also the ones found in the Federated Malay States.

Mr. Curtis, in the "Agricultural Bulletin of the Federated Malay States and Straits Settlements," has made the following observations :—" *Palaquium*, the tree referred to as 'Getah taban,' was

originally described as an Isonandra, but subsequently found not to agree in certain particulars with that genus, consequently a new genus was created, called Dichopsis. Later it was found that the characters of Dichopsis were identical with those of Palaquium, which, being of older date, takes precedence under botanical etiquette." The best gutta percha is yielded by a tree known as "Getah taban" in these States, of which there are several varieties—e.g., Taban merah—Palaquium oblongifolium or gutta.

Taban chaier—Palaquium sp.?

Taban puteh—P. pustulatum.

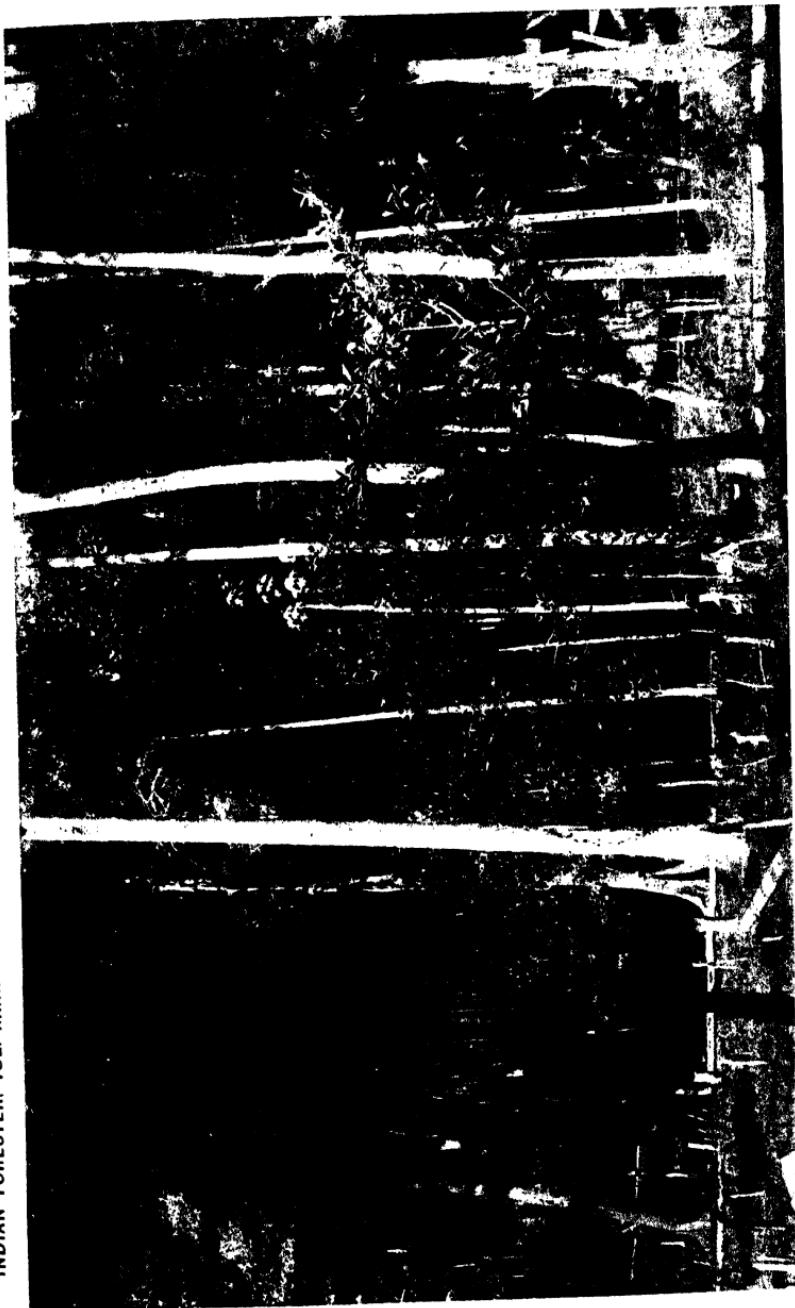
Taban baik—P. sp.?

Getah sundik—Payena Laerii.

All these are good except Taban puteh, which is much inferior to the others. Considerable doubt exists amongst botanists as regards the specific names of numbers 2, 3, and 4, and P. oblongifolium and P. gutta are by some considered as distinct species. Local names cannot be depended on at all, as they differ in the different States. Payena is not found in anything like such quantities as Palaquium, and it is chiefly with the latter that I propose to deal.

Palaquium gutta is found in all four States, the best areas lying between 2 degrees and 5 degrees north. It must be considered as a dominant species, but exists at present, owing to the unregulated and wholesale fellings by natives some years ago, only in the seedling and small pole stage.

It occurs most frequently on the low hills and plains, often on steep hill sides, and up to 2,000 feet above sea level, and even 3,000. It is found well represented in large blocks of forest, varying in size from a few hundred acres to 10,000 or 15,000 acres in extent, while it may be practically absent in other areas for long distances. On close examination a great many of the young plants are found to be stool shoots, but there are many seedlings also, although seed trees are not now to be found. This looks as if the felling of mature trees did not cease till comparatively recently. The "Taban" tree is a shade bearer of the most pronounced description, and is able to maintain the struggle for existence successfully, if



slowly, in these dense evergreen forests. It grows to a considerable size ; the largest I have actual knowledge of in this country was in Penang, and measured when blown down 52 feet in height and 42 inches in circumference at 14 feet from the ground. I have seen mention of a tree 140 feet high in the Philippines, and there is no doubt that it is an exceedingly slow grower. At present poles 30 to 40 feet high are fairly common in these States, but large trees are rarities. In the Straits Settlements *Palaquium* only exists in the natural state to a very small extent, e.g., in Malacca near Nyalas, not to mention a few scattered trees in Penang and elsewhere. We must rely in the Colony on our plantations or on the Federated Malay States, where large areas are found containing this plant in the wild state. At present a small plantation exists at Batu ferringi in Penang and another in Malacca and Singapore. The *P. gutta* tree is very easily recognised by its leaves, which are coriaceous, oblong or obovate-oblong and obtusely acuminate ; in colour they are of a beautiful coppery gold colour on the under surface, and dark glossy green on the upper. In a mature tree the leaves are about two inches long, but much longer in the young plant. In the forests this tree appears to be very free from the attacks of disease, the only one I have seen being in plantations, and caused by the larva of a moth which I believe to be a species of *Rhodoneura*.* This larva eats the young shoots and leaves, and has done appreciable damage in Malacca.

II. - MEASURES OF PROTECTION.

The qualities of gutta percha became known about 1845, and the demand steadily increased from that time, till in the seventies there was a rush for it by the natives of these States, the price rising rapidly till 1902. Between 1895 and 1900 the exports from Singapore rose from 2,642 tons to 5,831 tons. It may safely be said that from 1890 onwards the natives of these States were doing their best to obtain gutta percha. Their method of extraction consisted in felling every tree they came across and extracting the

* *Rhodoneura myrsinatis*, Wlk.

latex in a wasteful, rough and ready manner, so that by the time the authorities awoke to the fact that Palaquium was being exterminated (about 1898), it was too late to save trees large enough to produce gutta percha. It is difficult to see how this could have been prevented, however, as at the time there was no properly organised Forest Department, and whatever measures might have been adopted it would have been impossible to effectively carry out in these dense, unpopulated, evergreen forests.

In Perak the export of gutta percha was prohibited in 1881, but allowed again in 1887, the issue of passes to collect being prohibited in 1900. The first timber rules, published in 1898 by the British Residents of the various States, contained the initial protective measures, which were to the effect that no rubber-bearing tree should be felled if of less than 8 inches diameter. This rule could not, I imagine, be enforced in practice, owing to the want of an organised staff. In 1899 and 1900 the matter was taken up by the High Commissioner and the Resident-General, and in the latter year the British Resident, Pahang, issued orders to all his officers to do all that lay in their power to prevent the destruction of gutta percha producing trees.

The question of planting was also discussed, but not in a very practical manner.

The Forest Department was started in each State by the appointment of a local man, in Perak in 1895, in Selangor in 1898, in Negri Sembilan in 1899, and in Pahang not till 1902, when a member of the Indian Provincial Forest Service was sent over on deputation at my request, I having been deputed from India in October 1901 as Conservator of Forests.

Early in 1902 I suggested that an export duty of 80 per cent *ad valorem* be imposed on all gutta percha leaving these States, as a means of putting a stop to the extraction and collection of this product, a considerable period of absolute rest being obviously indicated for all gutta percha producing trees.

The rules were also amended and the felling of trees for the extraction of the latex was prohibited. In addition to these precautions departmental instructions were issued to the effect that

INDIAN FURNEDIER. TUL. AAAI.



H. C. Robinson, Photo.

High Forest of *Palaeoia gutta* with seedlings and poles beneath, all naturally grown.
(Federated Malay States).

no licenses for the extraction of gutta percha were to be issued. At the present time therefore it must be difficult to collect gutta percha and export it in sufficient quantities to make it pay. That a certain amount of smuggling goes on I have no doubt, from the fact that two or three cases have come to light in which Chinamen were found in possession of small quantities and were convicted of the offence. Since 1902 the staff of the Forest Department has been greatly increased, and I have reason to believe that the Government have done and are now doing all that is in their power to assist in the preservation of this valuable product.

As regards measures for protection from other causes of destruction, such as alienation of land for mining and agriculture, the only plan is to reserve all the valuable *Palaquium* areas, constituting them forest reserves wherever possible, without interfering with valuable tin-bearing land. We already have an area of about 60,000 acres reserved, fairly rich in young "*Palaquium*," chiefly in Perak and Selangor, and probably as much more remains to be taken up in Pahang and elsewhere.

Again, before any large area of land is alienated the department is referred to, and if alienation takes place in spite of the presence of *Palaquium*, we are given the opportunity of taking away the young plants and transplanting them into reserved areas. In the course of time, when all forest reservation has reached its natural limit, *Palaquium* is bound to disappear from all tracts outside, nor does this matter, as it is only practically possible to watch defined areas when placed completely under the control of the Forest Department.

The systematic exploitation of the gutta percha areas will only be possible in reserved forests, tracts being taken in hand annually.

(c) *Regeneration.*

The natural regeneration of "*Palaquium*," as already stated, is very good, but growth is slow and assistance must be given. Our object now is to encourage only the best species, *P. oblongifolium* and *gutta*. Regular plantations, *i.e.*, planting in cleared

areas from seed, is at present impossible in these States, as no seed is available. The method followed by the Forest Department here is to cut lines through the dense undergrowth in the forest reserves, taking up regular areas in turn, and to transplant into these lines young *Palaquium* seedlings taken from outside the reserve in forests that cannot for various causes be protected, or taken from groups inside the reserve where they are growing too close together. At the present time we have an area of more than 1,000 acres so planted in Selangor.

In the Trollah reserve in Perak *Palaquium* seedlings are so numerous in the seedling and pole stage that planting over a considerable area is unnecessary. Here we resort only to improvement fellings, transplanting young plants into blanks only wherever necessary. The improvement fellings consist in clearing away undergrowth interfering with young *Palaquium* plants, the operation being repeated yearly or once in several years, as may be necessary. By this means the rate of growth of the young trees is greatly increased. I have found the effect of this process to be very beneficial even in the two years since it was started. By such simple methods as these it is hoped in a few years to have a very considerable area of young *Palaquium* trees about 40 to the acre. One advantage in this system is the freedom from the attacks of insects to which trees grown in pure plantations are liable. A similar area to that in Selangor exists in Malacca, but the plants are put in closer together and were obtained from Sumatra. Similar plantations exist at Bukit Timah in Singapore, and at Batu Ferringi in Penang, but on a small scale.

III.—METHODS OF EXTRACTION.

The latex of *Palaquium* exudes immediately on tapping, *i.e.*, cutting the bark, and consists of a milky-looking white fluid, which, in young trees, is rather thin. It coagulates very quickly and turns in the case of "Taban merah," *P. gutta*, a light pink colour when hard. This is doubtless due chiefly to the fact that the under side of the bark of this species is reddish, and small pieces of the bark get mixed up with the latex while it is being rolled off. The



H. C. Robinson, Photo.

Natural Palaquium high Forest in Federated Malay States with undergrowth still uncleared.

rapid coagulation and the fact that the tree only bleeds for a very short time from the cut are at the root of the disastrous system of extraction of the latex, *viz.*, by felling the tree, tapping the living tree as with Para rubber, being, it was supposed, impracticable.

The native method is to fell the trees and to cut ring-like incisions round the fallen trunk at intervals of about 9 to 12 inches or even less. These are quickly filled by the latex, and in about half an hour the pure gutta percha can be rolled off on sticks. The product is then boiled and shaped as desired, but many impurities are included, such as chips of wood, bark, dirt, etc.

This process is of course very wasteful, as a good deal of latex falls to the ground; the latex which is contained immediately underneath the cut and touching the ground is also inaccessible. Again, the gutta percha contained in the leaves and remaining bark and in the twigs is not collected, and, as will be seen later on, this is a very considerable amount.

The same method is applied to *Getah sundik*, *Payena laerii*, which produces a very white gutta percha.

Dr. Sherman, in the Philippines, estimated that only 1/35 of the total quantity contained was extracted by natives, and from other experiments it is said to be certain that not more than 1/10 is obtained.

In Penang in 1900 a tree was felled 39 inches in circumference at 5 feet from the ground, with a height of 55 feet, height to the first branch being 35 feet. This tree was thought to be about 50 years old. The gutta percha was extracted by the above mentioned native method under the personal supervision of the Superintendent of the Botanic Gardens, and yielded only 1½ lbs. of gutta percha. Another tree blown down in 1901, 52 feet high and 42 inches in circumference, yielded by the same method 1½ lbs. only. Dr. Sherman had a tree felled in the Philippines 160 feet in height and 8 feet in circumference which yielded only 8½ lbs., whereas he estimated that could all the latex in the leaves and bark have been obtained he would have extracted 150 to 200 lbs.

Other methods of extraction have been tried, *e.g.*, from the leaves and bark. The green leaves of the best species of Palaquium contain up to 3 per cent of pure gutta percha and the bark about 5 per cent. A company was started in Singapore which, by simple mechanical means, extracted gutta percha from them, but I believe that great difficulty was met with in the procuring of sufficient leaves. I believe this method of extraction could be employed by the Native States were the necessary plant set up close to the forest. Extraction can also be effected from dried leaves by this method, but there is great loss through oxidisation while drying gradually.

There are also various methods of extraction of the latex by chemical means, but I believe I am right in saying that these are less satisfactory as regards the produced gutta percha. I am very doubtful whether extraction from the leaves only, *i.e.*, from leaves gathered from standing trees without tapping the tree, would be a success from an economical point of view. From what we know, the best method would seem to be to fell the tree, but to extract every ounce of latex from the bark, twigs, and leaves of the felled tree. This would not present any great difficulties. In any case it is obvious that the method of collection from leaves only is a most dangerous one if carried out by natives as they cut down the young saplings in order to reach the leaves, otherwise inaccessible without great trouble, whereas were they collecting by their own methods it would not pay to fell trees of less than a certain size. Again, Palaquium appears to be a very slow growing tree and what effect the stripping of some or all of the leaves, even at considerable intervals, would have is very uncertain. So far the Forest Department in the Federated Malay States has not concerned itself greatly with methods of extraction; all its energies must for the present be devoted to the protection and cultivation of the trees. There is ample time in which to make experiments. Lately some fairly large trees have been found in the forests, and I intend, before long, to make experiments in tapping the living trees; it is quite possible that, by tapping the tree from the base upwards to a considerable height, a good quantity

of latex may be obtained without seriously affecting the vigour of the tree. Of this, however, I have no great hopes, as I have heard that tapping as hitherto attempted has had an injurious effect.

I may here mention that from the leaves of *P. pustulata* which I sent to Singapore but very little gutta percha could be extracted; in fact, practically none at all. From *P. gutta*, however, over two per cent was obtained, but I am informed that the gutta percha so obtained is not of the first quality and will not do for cables.

IV.—MANUFACTURE AND TRANSIT.

According to M. Collet, who published a pamphlet on the subject, nearly all the gutta percha of commerce goes to Singapore, where it passes through the hands of Chinese middlemen, the cleverest adulterators in the world. To such an extent has adulteration been carried on that the finished article they turn out resembles but slightly pure gutta percha as taken from the tree, and he adds "it is impossible to determine the origin of the gutta percha as comprising the *reboiled* of Singapore." This is greatly to be regretted, and I feel sure that the present enormous fall in price is partly accounted for by the adulteration to which this product has been subjected. As will be seen further on, the prices lately quoted in Singapore for gutta percha are less than those current for very ordinary India rubber of low grade. It is a well known fact that the exports of gutta percha from Singapore greatly exceed the imports. This is, however, partly explained by the fact that very inferior "Getahs" such as "Jelutong" (*Dyera costulata*) are shown when imported as inferior India rubbers, and then mixed with gutta percha and exported as such. "Jelutong" can hardly be called a gutta percha however, and this only bears out my statement. Whereas the price of gutta percha rose in 1902 to \$600 per pikul (1 pikul = 133½ lbs.) the average price of Getah Jelutong is only \$6·50 cents. Gutta percha also finds its way into Singapore under the name of India rubber; also a certain amount is brought in by passengers and smuggled through in small quantities at a time.

V.—PROPERTIES OF GUTTA PERCHA.

As is generally known, pure gutta percha when heated becomes soft, malleable and plastic, but when allowed to cool it becomes hard, retaining any shape given it when hot. Pure gutta percha is so hard that it would be difficult to drive a nail into it when in the cool state. In composition it differs from India rubber physically more than chemically. It burns freely with a very characteristic odour. When exposed to air for any length of time it oxidises, when its insulating qualities and durability decrease, but if kept in water its duration is indefinite.

Acids do not affect it unless concentrated.

Its chief value of course arises from the fact that it is unaffected by sea water; this and its insulating qualities make it invaluable for submarine cables.

The chemical composition according to W. P. Brant is as follows:—

Carbon	86·36
Hydrogen	12·15
Oxygen	1·49
<hr/>	
	100·00
<hr/>	

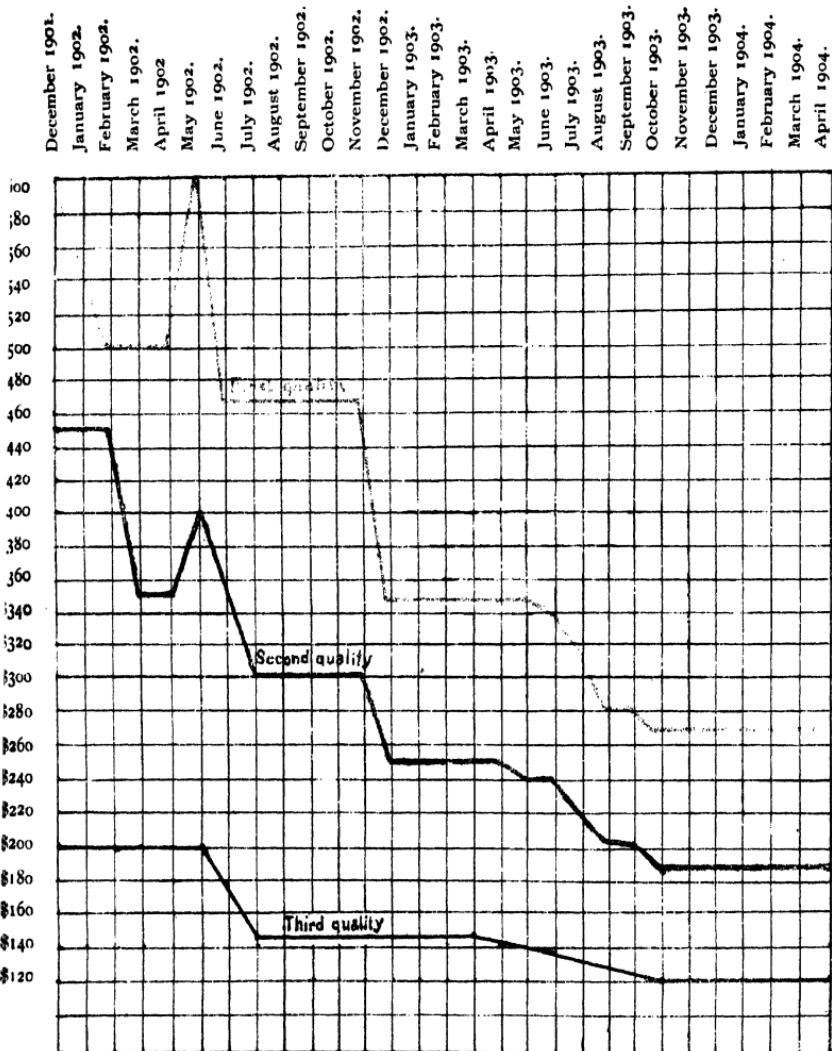
Its physical composition according to Payenna—

Gutta	78·82
Albane	16·14 (crystalline resin)
Thiarite	5·04
<hr/>	
	100·00
<hr/>	

It is a great pity that in Singapore and in the Malay States generally the term "gutta" is used indiscriminately to mean either India rubber or gutta percha, as this leads to great inaccuracy in returns.

SOME FACTS ABOUT THE TRADE.

In 1880 Great Britain imported from the Straits Settlements 68,862 cwt. of gutta percha valued at £505,821, while in 1876



NOTE.—The difference in price between the three qualities is much smaller in April 1904 than in December 1901, when prices were high. This appears to me an indication of deterioration of 1st and 2nd quality.

the imports were only 19,665 cwt., and in 1878 49,387 cwt. Thus it would seem that the rush for this product came on between 1876 and 1880, or within the last 28 years. In 1890 the price was 316 per pound, but rose to \$4.60 cents in 1902.

The exports from Singapore for the last 18 years are as follows :—

1886	Pikuls	33,946.	1895	Pikuls	43,910.
1887	"	25,539.	1896	"	43,769.
1888	"	23,717.	1897	"	45,417.
1889	"	59,493.	1898	"	93,398.
1890	"	78,930.	1899	"	78,343.
1891	"	54,026.	1900	"	97,399.
1892	"	41,990.	1901	"	73,815.
1893	"	38,045.	1902	"	63,559.
1894	"	42,841.	1903	"	35,661.

The question which naturally forces itself on one's mind is, will there be any demand for gutta percha by the time the Federated Malay States forests have been given time to recuperate? A substitute may be invented or submarine cables may become unnecessary ; either of these two contingencies failing, it is difficult to see why the demand should not be even greater than heretofore. In this case it will be advisable for the Government to transmit its gutta percha direct to agents or manufacturers at home, and above all not to send it to Singapore to be changed beyond all recognition by the Chinese middlemen. Appended is a statement of the highest prices of three qualities of gutta percha exported from Singapore during its zenith and decline. I am told that this decline of first quality is largely due to the falling off of the demand for the best quality owing to the cessation at present of work on laying cables, but do not think this the only cause.

For the photographs here reproduced I am indebted to Mr. H. C. Robinson of the Selangor Museum. They represent a forest in which the dense undergrowth has been cleared, showing up the young *Palaquium* plants, those with the rather stiff looking leaves. In Plate xxviii the tall sapling in the centre is a *Palaquium gutta*, also the one close to it.

Plate xxx shows a group of seedlings and small poles under the big forest.

Plate xxxi the same ; these are all naturally grown. It is difficult to obtain good photographs owing to the bad light.

Plate xxxii shows some forest not yet cleared of undergrowth ; the tree with the white light on the stem is a Palaquium.

HERBERT SLADE, O. U. S. E.

On the 12th March last Mr. H. Slade, Conservator of Forests, died suddenly of cholera at Akyab, to the great regret of all who knew him.

Slade was educated at the Nancy Forest School, and joined the Department in Burma in December 1882. After serving for a few years in Lower (then British) Burma he was sent, after the annexation of Upper Burma, to the new Province and placed in charge of the Chindwin Division, an immense area containing some of the richest teak forests in Burma. After some years of arduous work in the Chindwin, his services were again claimed by Lower Burma, and he was, until his departure for Siam, in charge of the Tharrawaddy Division.

In 1896 he was deputed to Siam to form a Forest Department there. In the face of great opposition—even from quarters whence he had a right to expect help—he succeeded in putting a stop to the old, strongly-ingrained, illicit methods, in establishing the proprietary right of the Crown to its forests and in setting up a properly constructed Forest Department. This was a grand performance, yet Slade left Siam greatly disheartened at his failure to get through certain measures, which were, however, afterwards recognised to be necessary. In 1899 he received the Third Class of the Order of the White Elephant of Siam.

Since his return to Burma in 1901 he had been in charge of the Pegu and Northern Circles. At the time of his death he had just relinquished charge of the latter Circle, and had proceeded to Arracan on special duty to organise forest work in that Division.

Slade was of the best type of Englishman—absolutely simple and straightforward. He was honoured and respected by every officer who had the pleasure of serving under him. He was in fact always most popular through the great charm of his character. While the State has lost a strong and capable officer we who knew him have lost even more—a dear friend.

The Lieutenant-Governor of Burma recorded his appreciation of Slade's services in the following notification published in the Burma Gazette :—

The Lieutenant-Governor has heard with deep regret of the death at Akyab on the 12th instant of Mr. H. Slade, Conservator of Forests. Mr. Slade, who joined the Forest Department in Burma in 1882, was an officer of unusual knowledge and ability, whose services have been of great value to the Local Government. From 1896 to 1901 he was employed in Siam, where his successful administration of the forests was rewarded by the grant of the Third Class of the Order of the White Elephant. By his untimely death the Government have lost one of their most capable and devoted servants.

THE GRAZING QUESTION IN MADRAS.

BY F. A. L.

The future of the forests depends so much on the amount of grazing that they can be saved from, while the present of the ryot depends (or is said to depend) so much on the number of cattle which he can maintain at a nominal cost, that it appears impossible to reconcile these two divergent interests. The interests of the cultivator are rightly considered of paramount importance, and it is impossible to convince the ordinary ryot that grazing restrictions, necessary from a forest point of view, are advantageous to him. For generations he has been accustomed to keeping as many cattle as he could find food or water for, not for tilling his land, but as the cheapest and most convenient method of bringing produce from the forests and depositing it in the form of manure on his land. In what may be called, so far as forestry is concerned

the prehistoric days prior to the introduction of the Forest Act, certain areas were selected as reserves; these areas were theoretically closed to man and beast, and it was probably for this reason that an order was issued to the effect that no reserve should include any public path. Consequently the reserves were very limited in area, and as free grazing was allowed everywhere except in the reserves, their formation did not materially diminish the area available for cattle of all descriptions. But with the reorganisation of 1882 and the introduction of the Forest Act, reserves were soon formed on a large scale, and the old idea of the word "reserve" being synonymous with "area rigidly closed to man and beast" had to be modified. In 1885 Mr. Gamble advocated light grazing in the Nilgiri reserves, and in the same year Colonel Campbell Walker declared himself in favour of light grazing in the forests of the plains, defining "light" as one head of cattle per five acres of forest after excluding all bare and rocky patches. Various proposals for limiting the number of cattle to be admitted to a reserve were made, but they all failed, those on the "first come first served" principle because local cattle-owners might be excluded from a reserve by the prior advent of an exotic cattle breeder with a large herd, and those on the villageman distribution principle because of the impossibility of effecting an equitable distribution by the forest staff then available or by village officers. It was then decided that no restriction on the number of cattle to be admitted to the reserves could be attempted, and grazing permits for which nominal fees were charged were issued to all-comers. At first these permits held good for all the reserves of the district in which they were issued, and in the hot weather as soon as the pasture in one reserve was exhausted, by overgrazing or by fire, the cattle were moved on to the next reserve irrespective of the number of cattle it might already contain. The results, in a bad dry season, may easily be imagined; half-starved cattle from a reserve which had been cleaned out of fodder or water crowded into the nearest reserve and accelerated the disappearance of the available fodder therein, after which, augmented by the cattle which habitually grazed there, they moved on to overcrowd a third reserve, and so

on, till they reached a tract of forestless country which they were too feeble to cross, and there they died by the hundred.

In order to prevent this reoccurring and to ensure a certain distribution of cattle, the area for which permits held good was reduced ; the unit of area became part of a reserve, a reserve, or a group of reserves according to circumstances, but still no restrictions on the number of cattle to be admitted to each unit were imposed. If a cattle-owner wished to transfer his cattle from one grazing block to another, he had to pay for new permits for the second block, and though the grazing fee was and is quite nominal (three annas per cow per annum) this double payment gave rise to numerous petitions. It has no doubt augmented the grazing revenue in many districts, but the cattle-owner considers it an injustice and has good arguments on his side. Owing to the absence of all restrictions on the number of cattle admitted to each block, certain favourite blocks soon get overcrowded with local cattle to which in the dry season are added herds of breeder's cattle ; fodder or water or both fail, and the cattle-owners who have paid for grazing for a year demand that they may be allowed to move their cattle without further payment to a block which contains fodder. I use the word *fodder* instead of *pasture* advisedly, for in many of the reserves in the plains, after the disappearance of all pasture, cattle are fed on the leaves of trees, cowherds lopping off branches freely, and at the end of the hot weather these overgrazed reserves present a pitiable spectacle : ground as hard as iron and as bare as a rock, not a leaf or a green shoot within six feet of the ground, trees barked and lopped in all directions ; no wonder that natural reproduction hardly exists in the reserves, and as for the unreserved lands they are past praying for. From the moment that payment was demanded for grazing in reserves, the pressure on unreserved lands increased ; no man would care to pay three annas on the chance of getting grass in a reserve so long as he could keep his cattle alive on the unreserved lands, but as the area of reserves increased the free grazing area diminished and also the free felling area, with the result that the denudation of unreserved lands was enormously accelerated, and most of them are now

useless for pasture except during the monsoon months. Goats of course were the principal factors in the work of denudation and destruction, and in some districts their depredations are still allowed even in reserved forests because the ryots say that goats are necessary to agriculture; in other districts, however, the imposition of a grazing fee of from eight to twelve annas a goat has resulted in the disappearance of a large proportion of the herds of goats formerly maintained, and it has not been shown that agriculture is any the worse off in consequence. If it is true that "nature abhors a vacuum" it is equally true that "forests abhor goats," and as a well-known French Forest Officer said with reference to the goat question in Algeria, "If anybody will show us how to grow goats and forest on the same area we shall be much obliged, for no Forest Officer has yet succeeded." Goats must sooner or later be relegated to unreserved lands, the denudation of which will limit the number that can be maintained; they should not enter into the question of provision of grazing in reserved forests.

What then will be the future development of the grazing question? If unlimited grazing continues, deterioration and eventual disappearance of the forests must be the result. There is no doubt that unlimited grazing is not the best treatment for the forests; is it the best for the cattle-owner? Under it the local cattle-owner finds the reserves in his vicinity overrun with cattle belonging to breeders; he pays a grazing fee with no certainty of obtaining grass for his cattle; at best his cattle get half rations and deteriorate, and in times of scarcity he loses many that might have been saved if the number of cattle admitted to the reserve had been limited to its grazing capacity. Given a sufficiency of grass his cattle would improve, and so would the forest growth on which he counts for his building and agricultural materials. In fact it is generally admitted that unlimited grazing is an evil, but the difficulty of restricting the number of cattle without hardship to the poorer cattle-owners has hitherto prevented any attempt at limitation. The difficulty is not insurmountable, but requires careful treatment. Firstly, what are the classes of cattle for which

grazing has to be provided? They may be divided into—(1) plough and domestic cattle, (2) cattle kept for the value of their manure, (3) cattle kept for breeding purposes. The country would not suffer materially if class 2 were eliminated; other manures and other means of bringing manures to the fields would soon take the place of these manure collectors, and the quantity of straw and pasture available for use by the remaining two classes or for sale would be so largely increased that fodder famines would become rare. Class 1 has to be provided for locally, and class 3 in the large forests in which local demand falls far short of the supply of pasture. In 1890 the Madras Government outlined a scheme for light grazing and stated that cattle required for agricultural and domestic purposes must have first claim on reserves; that if this were not done the result of protection would simply be a large increase in the number of animals requiring pasture and the consequent failure of all efforts to permanently improve the grazing grounds; it further considered that grazing should be provided for the cattle of every landholder at the rate of two bullocks and one milch cow for every five acres of land occupied. Unfortunately this does not seem to have been brought into force, either from want of establishment, or from want of reserves. It is quite conceivable that an isolated reserve of, say, 1,000 acres extent may be surrounded by villages containing 10,000 acres of occupied lands, and the grazing demand based on the above scheme would amount to 6,000 head of cattle. No scheme for the distribution of grazing can succeed unless it is based on the amount of grazing available. It has been suggested that the grazing fees should be raised until the demand is reduced to the grazing capability of the reserves, but this would entail the exclusion of the poorer classes of ryots in favour of the wealthy landowners and the cattle-breeders. It would, on the other hand, diminish the number of cattle kept for manuring purposes, and this is one of the principal objects to be attained in localities in which the demand for pasture exceeds the supply. In such localities the ryot must learn to substitute other forms of manure, and an increase in the grazing fee would make him seek a different method of enriching his land. It is only the

existence of cattle kept for manuring purposes that necessitates the grazing fee being kept at its present nominal sum ; in some districts higher fees are charged for breeders' cattle, and in most districts plough cattle are stall fed. A gradual increase in the grazing fee might therefore be allowed. But the complaining ryot always excites sympathy by the plea that he cannot afford to pay grazing fees for his agricultural (*i. e.*, plough) cattle, and has been known to make this an excuse for his inability to pay his land assessment ; this of course is no argument against the levy of moderate grazing fees, for if the land assessment is so high that the ryot cannot afford to spend three annas per annum on the maintenance of each bullock required for cultivation purposes, it is evident that the land tax is excessive ; the same argument would apply if instead of three annas the grazing fee was three rupees, which for a yoke of bullocks comes to 3¹5 pies per day, a sum considerably below the actual cost of stall feeding. It would, however, be impossible to suddenly raise the grazing fees by any considerable amount and, though a gradual increase in fees will lead to a gradual decrease in the number of cattle, some other means must be adopted to put a stop to the excessive grazing in reserves while at the same time safeguarding the interests of the small and poor landholders. This can best be done by bringing into force, with certain modifications, the Government scheme of 1890.

No grazing block should contain more than one compact block of forest ; it is immaterial whether the block is a reserve, a group of reserves, or a portion of a reserve ; the division of forests into grazing blocks must depend on local circumstances. From every village adjoining a block the Kurnam or village accountant should submit a statement showing the number of landowners holding (1) less than five acres of land, (2) from 5 to 10 acres, (3) from 10 to 15, and so on ; from these statements the grazing demand should be calculated at the rate of two plough cattle and a cow for every five acres, or other unit (the area worked by a yoke of cattle varies enormously in different districts or even in parts of one district) ; the grazing "possibility" of the block should also be calculated, and if the possibility exceeds the demand grazing

permits can be issued to the landowners in proportion to the extent of their holdings ; if, on the contrary, the demand exceeds the possibility, the issue of permits must be limited to the latter, and must be proportionate to the individual demand.

In the first case (possibility exceeds demand) the question arises, what is to be done with the excess grazing available? If, within reasonable distance, there is a grazing block in which the position is reversed, the excess can be allotted to the villages concerned ; in other cases it may be allotted either to manuring cattle or to breeders' cattle, according to circumstances; if to local manuring cattle the grazing permits might be sold by auction, if to breeders' cattle they might be sold at fixed rates, higher than those charged for plough cattle which are kept low in the interests of agriculture. In the second case (demand exceeds possibility), what is to happen to the cattle for which permits are not issued? Unless other grazing blocks are available in the vicinity it will be a case of the survival of the fittest. The Forest Department cannot give more than it has got ; if there is pasture for 1,000 head, and the demand is for 2,000 head, either the forest or the cattle must go ; now, every acre of forest that goes means decreased pasture, and the result of sacrificing forest to cattle would be that in a few years' time the possibility would be 500 head instead of 1,000. It is evident therefore that in order to maintain the amount of pasture available the excess number of cattle now existing must disappear or be supported in some other manner.

The above scheme provides cheap grazing up to the amount that the forests can support for agricultural cattle and ensures a fair distribution of permits among landholders, and this is as much as Government can be expected to undertake, but what will be the result when the demand for pasture exceeds the supply? By the universal law there must be an increase in the price of the commodity in demand, and as actually most of the plough cattle are stall fed, the permits issued at a low rate for a certain purpose will be sold at a premium to the owners of herds of manuring cattle ; the small land-owner with his one pair of bullocks will get no grazing for them in the reserves (he does not require it!) but will

CORRECTION SLIP.

P. 329, line 23, *for* 'regulations' *read* 'regulation.'

P. 333, line 27, *for* 'proportion of a class trees' *read* 'proportion of I class trees.'

make a few annas by selling his permits to his rich neighbour, and this will pave the way for a general increase in the grazing fees in a few years' time. If then the eventual result of this scheme, which involves a great deal of work, is the increase of grazing fees, would it not be simpler to go straight to the end and gradually raise the fees? I think not, because the above scheme limits grazing to the possibility of each forest *at once*, whereas the gradual increase of fees would take years to effect the same object, and in the meantime the possibility would be steadily diminishing.

CORRESPONDENCE.

THE TREATMENT OF SAL FORESTS UNDER THE SELECTION SYSTEM.

In the numbers of the *Indian Forester* for September and October 1904, we have an interesting article by "More Light" on "Proportionate Fellings in Sal Forests," which the author concludes with an invitation to criticism. I venture to make the following remarks in the hope that the result will be "more light."

In the first place the title of the article is an unfortunate one, likely to lead to confusion in the minds of those who have followed the discussion on "Proportionate Fellings." This began, I believe, with an explanation by Mr. Gleadow in March 1901, of a method advocated by M. Broilliard in the *Revue des Eaux et Forêts*. Mr. Gleadow finally stated that the method was only suitable to complete and uniform crops, though I see no reason why it should not be applied to a properly stocked irregular crop under the selection system. That "More Light" considers his system the same as, or a mere modification of, M. Broilliard's is shown by the title of his article and the following on page 449—"We cannot therefore associate ourselves wholly with the view that Proportionate Fellings can find no place in half-ruined forests." "More Light's" scheme bears no resemblance at all to M. Broilliard's and therefore his title is a confusing misnomer. This requires a short justification.

I understand M. Broilliard's "Proportionate Fellings" in the case of a forest under the selection system to be this—

Assume we are dealing with a European forest which has been under regular treatment for a considerable period and which for all practical purposes is normal in density, quality and distribution of the age-classes. It is known from measurements in sample plots that it takes, say, 30 years for the oldest age-class to be replaced by trees in the next oldest. It is decided to visit every part of the area once in ten years. It follows that the mature stock will be removed in the course of 30 years by taking one mature tree out of three at each felling. In the course of ten years one-third of the second age-class will have become mature, consequently the proportion at the second felling will remain one out of three and the same at the third felling. The main idea is that *all preliminary enumerations are avoided* and no faulty calculation of the possibility is made. The crop being complete, no great variations in annual yield can take place if equal areas are treated every year. As far as I understand Mr. Gleadow's explanation, the question of thinnings in the younger age-classes is not included, though it is not impossible to extend the method to them, but as I hope to show further on it is doubtful if such operations lend themselves to regulations by calculations of any sort.

On the other hand, the first necessity in "More Light's" method is a full enumeration of the whole growing stock. The figures thus obtained are to be compared with a calculation of the normal growing stock and the result is to be used as a check on over-felling or underselling, according as the girth-class under treatment is in deficit or excess.

Taken literally the words "Proportionate Felling" mean any felling in which one takes a proportion of the trees; in other words, any felling which is not a clear felling. In this broad sense "More Light's" method is a proportionate felling, but it is certainly not the method originally given that name by Mr. Gleadow.

We can, however, turn to another method for treating sal forests, put forward by Mr. Gleadow, for a parallel to "More Light's" proposals. This is his method of "Storeyed Forests"

explained in the *Indian Forester* for February 1900. Though the able author may object to my saying so, this method comes legitimately into a discussion of sal forests under the selection system, for I can only see in it the selection system worked out to its theoretically correct end of treating *all* girth-classes and regulating their proportions. In the method of storeyed forest it is proposed to calculate the normal proportion of each girth-class by measuring the areas of crowns and with a knowledge of these figures to make use, at each felling, of the trees in each girth-class in excess of those required in the next higher, and in abnormal forest to regulate our fellings so as to gradually introduce the proper proportions on the ground. "More Light" proposes exactly the same thing. However, there are two differences in the detail of the systems. Firstly "More Light" proposes to enumerate the whole stock first and then to calculate for each girth-class whether it is necessary to mark surplus trees or avoid fellings altogether. Mr. Gleadow, on the other hand, would mark the proper proportion on the ground in reserve and fell the balance, if any. He thus spreads his enumerations over the whole felling period, but he loses the advantage of being able to equalise the annual outturn approximately. Secondly, "More Light" omits altogether the theoretical possibility of felling all the trees in any class in excess of those required in the next higher—he confines himself to removing the excess over the normal proportion of the class itself. For example, the proportion of II class trees at commencement of a felling is 12 per acre, of III class 17—on the ground there are 24 III class. "More Light" only proposes to fell $24 - 17 = 7$ III class, whereas he might fell $7 + (17 - 12) = 12$. The crux of both methods, or, as we may more truly say, of the *one* method, is the utilisation of crown-areas for a knowledge of the normal growing stock. This idea has, to my thinking, a fatal fallacy, a fallacy which "More Light" fails to recognise, and therefore his scheme falls to the ground. Mr. Gleadow fully recognised the fallacy; and indeed an important part of his article on "Storeyed Forests" is concerned with explaining it. Nevertheless, although he gives us no idea of how he proposes to get over

the difficulty, he continues to advocate "the crown-area" theory.

The fallacy lies in the assumption that each girth-class occupies an equal portion of the area in a normal forest. The statement that this is not so was described by Mr. Gleadow as the "Gurnaud principle." It is easy to be wise when one has been told how a thing is done, yet I think that we hardly need M. Gurnaud to tell us that in a properly stocked selection forest the youngest of five girth-classes, or the next youngest, does not require or get one-fifth of the total crown-area all to itself. One does not need to go ten yards in a sal forest without noticing that much of the available crown-area is occupied by two or even three girth-classes at once. Mr. Gleadow was therefore reduced to assuming the proper area required by each girth-class, and we are therefore no nearer a knowledge of the proper proportions of the girth-classes in a normal sal forest than we were before. This was pointed out by Mr. Leete in his article on "Sample Plots," Part IV, apropos of the working plan for the Kheri Trans-Sarda Sal Forests which he was then writing. For want of the necessary knowledge of the normal proportions of the girth-classes, he was obliged to limit his treatment of the sal forests to the removal of mature trees and of rotten material from the smaller girth-classes, but he fully recognised the possibility of utilising the excess material in the smaller classes and made most practical suggestions for obtaining the necessary data.

We have spoken so far as if we would be glad to fall in with the scheme of conducting the whole of our fellings on the basis of comparison of actual and normal growing stocks, if we but knew what the latter really is. As we do not know it we have time to pause and ask if this comparison would really prove so useful. I do not deny that if we knew the normal number of I class trees per acre, it would be very sound to see that we had something more than that number of II class trees on the ground before felling any trees of that class or before removing any excess in the III class.

Also, in case the II class were in excess of the number required for a normal I class, it would be possible to remove the

excess without endangering the quality of the crop. The principle might possibly be extended to class III. But when we get to the still younger classes the question is different. Suppose as before the normal number of II class trees is 12 per acre, of III class 17 and IV class 20, there are 24 III class trees and 30 IV class on the ground. We can theoretically remove 12 III class and 13 IV class trees per acre, but to do so would be to ruin the forest. Both Mr. Gleadow and "More Light" fully recognise this and only advocate the use of the comparison as a guide. The question then arises forcibly—Is not the difference between what you can fell theoretically and what you can fell actually so great that the guide ceases to be any guide at all. Not only this but "More Light" proposes to carry out thinnings twice in the period in which one class passes into the next higher, which makes the guide more shadowy still. Moreover, I am inclined to consider the original proposition that the trees in class III, in excess of the normal number in class II, are theoretically removable, a fallacy. Is it not more correct to say that theoretically all the trees are required to produce the requisite amount of upward growth, but experience shows that the crop profits by judicious thinnings. We shall do better then to exercise our minds in determining what is a good sylvicultural thinning among sal poles rather than with calculations of normal numbers of trees per acre.

To return to our numerical example, we have decided that the removal of the $17 - 12 = 5$ III class trees is probably better regulated by the study of sylvicultural thinnings than by calculations and that of the corresponding IV class certainly so. It still remains possible, as proposed by "More Light," to remove the $24 - 17 = 7$ III class trees and $30 - 20 = 10$ IV class and thereby to introduce the normal proportions in an abnormal forest; but it is done by utilising a large quantity of immature stock. It would be apparently far sounder to remove the excess from the present III and IV classes when the trees are mature, by keeping the surplus to supply the deficiencies in the present I and II classes or at least to compromise by spreading the process over

a considerable period. By that time we may know the normal proportions and the question will be within the boundaries of practical forestry. Further, I think it will be found in practice that all this talk of removing excess III and IV class trees on the assumption that so much is being added to the deficit in the V class, resulting from the felling of a deficient I class, is nothing but talk. A large proportion of the III and IV class trees do not stand scattered about as they should do, but are in large groups, and to remove trees would reduce the number in the class, but in the absence of seed bearers would do nothing towards the production of regeneration. As already indicated, the only thing required in such areas is a judicious thinning.

I am not aware that any working plan for sal forests under the selection system has yet gone further than providing for the removal of mature trees under sylvicultural rules with a check, based on enumeration, against overfelling by reason of a possibly too short felling period, combined with removal of really useless and rotten trees in the other girth-classes. The last working plan of this kind brought out certainly shelves the question of thinnings. I venture to put in a precise form a few suggestions for a slight advance in the present and with indications for the future—

(1) That enumerations of the stock should be used to equalise the outturn from mature trees by departing from the system of possibility by equal areas.

(2) That with a knowledge of the normal proportion of a class trees per acre, we should arrange to provide something more than this number of II class on the ground.

(3) That failing this datum at present, the enumeration of stock should certainly be used for seeing that we have on the ground after felling at least as many II class trees as we have had I class, with a liberal addition for casualties and trees which never attain the I class. This principle could be extended to III class, if necessary.

(4) That it may be found advisable eventually to provide a normal number of III class trees on the ground, as for II class

trees, but that probably III class had better be treated with IV class on sylvicultural lines only, i.e., by thinnings.

(5). That in the immediate future working plans should provide for judicious thinnings of clumps of sal poles and not restrict the removals to absolutely rotten stems. What is a judicious thinning will be a difficulty, but if we never try we shall never learn. Whilst the conditions in other circles are, doubtless, different, in this circle, at any rate, the Divisional Officer would certainly have spare time available to devote to thinnings.

It is perhaps hardly necessary to add that in the case of ruined sal forests, the absolute necessity for getting rid of large quantities of worthless trees in the larger girth-classes must prevent any attempt at making provisions for the future in the matter of II and III class trees, but it is here assumed that we are dealing with forests which have already been treated with improvement fellings.

F. F. R. CHANNER.

NOTE.—The girth-classes referred to are 18 inch classes; class I being trees over 6 feet in girth and class V, 0 to 18 inches. The question of whether these are the best classes is not considered here.

ON CERTAIN IMPORTANT FOREST QUESTIONS.

In his letter in the February number of the *Indian Forester* Mr. Gamble states that Mr. Hauxwell and myself consider that things are all right now. I can find nothing in my letter in the number for May 1904 to justify such a conclusion, which certainly does not correctly represent my opinion.

The only sentence in my letter on which Mr. Gamble could possibly have based his conclusion was the one quoted below, and there were many others from which he might have drawn quite a different one—

"I may add that I don't think we should have much difficulty in respect of money for improvements if we had or could obtain the necessary establishment to carry them out."

S. CARR.

THARRAWADDY:

23rd March 1905.

THE DECREASE OF FIRES IN THE NORTHERN CIRCLE,
BOMBAY.

With reference to my recent letter (printed in the May issue) on the decrease of fires in the Northern Circle of Bombay I have a modification to introduce, which did not occur to me at the time of writing, although perfectly well known. Without diminishing in the least the credit accorded to the Collector, it is nevertheless necessary to record the other cause, which is the *abolition of "kolpat"* (deadwood) *contracts*. Revenue was formerly made by selling a quantity of green timber at certain prices, and a quantity of dry timber at smaller prices, the contractors choosing the trees. Of course they burnt the forests wholesale and even piled dry wood round specially fine trees. Such a system was a terrible shock to my nerves when I first came to this circle, and I did my utmost to abolish it, but the effective agent was the introduction of Working Plans. Still there were lots of other causes of fires, all but a minute few being traceable to privileges or incendiarism. Complimenting a certain Revenue Official the other day, I referred to the great diminution of fires and asked the reason. He said at once "Well, sir, you know the relations between Forest and Revenue Officers were not quite the same in those days."

I am glad to see my old friend J. S. Gamble to the fore. He was, I thought, unnecessarily and uncivilly attacked, and I am glad to see that he has the best of it. I certainly did not take his "Old Forester" as a slighting expression, but the contrary.

F. GLEADOW.

COAGULATION OF THE LATEX OF FICUS ELASTICA.

I noticed in an article on the above subject in that estimable journal the "Agricultural Bulletin of the Straits and Federated Malay States" of January last that Mr. P. J. Burgess makes a statement that *Ficus elastica* latex refuses to coagulate, and that he has devised a method of churning it up with a 2 per cent solution of tannic acid in the proportion 5 parts of solution to 95 latex. He also states that the *Ficus elastica* yields an abundant latex which

can be easily collected and which is quite liquid and remains so for an indefinite time.

It may perhaps interest your readers to know the experience of one who has tapped and watched the tapping of *Ficus elastica* trees for the last three years in the Government Plantations of Charduar and Kulsi in Assam, where the latex of *Ficus elastica* by no means remains liquid for long. The cuts are made by a V-shaped chisel or gouge devised by Mr. D. P. Copeland, Deputy Conservator of Forests ; they are made at right angles more or less to the line of growth of the stem, aerial root, or branch at one and a half feet apart half round the trunk, aerial root or branch that may be tapped. Cuts made vertically to the line of growth do not yield so much rubber for a similar length of cut as those made horizontally. Endeavours are made to cut only just down to the cambium layer and not into the wood so that the wound may heal as soon as possible. Immediately after the first cut the latex flows freely, fills up the gaping cut and flows over, but before very long, say within two minutes at the outside, the flow ceases because the latex begins to coagulate of its own accord in the cut. Arrangements are made to collect the latex that falls on mats made of thin strips of bamboo woven together. Little boys on the ground shift these mats about under each cut as the man up the tree makes it so that the dripping latex can cover the mat. Before the end of the day this dripped rubber has joined together on the mat and has coagulated and formed a regular skin, which on drying can be pulled off, say, in 48 hours or less sometimes and be further dried. The latex which has coagulated in the cuts turns a reddish brown colour, highly appreciated in the London market, and is pulled out of the cut in about 48 to 56 hours, afterwards yielding fine elastic fids of rubber.

This rubber is then slightly handpicked to get rid of pieces of bark, dirt, etc., and is laid out on shelves in an open shed to be air dried. After drying this fine red rubber which coagulates in the cuts is pressed by a screw press in cubes of one hundredweight each, which are wrapped round with cheap white cloth and a double covering of gunny bag. The cubes retain their shape and are easily

portable. Such rubber has fetched four shillings and three pence a lb. recently in the London market. The latex which dripped on the mats is similarly cleaned, dried and packed separately and realizes very little less. This latter, which we locally name "mat" rubber, is sometimes liable to ferment as some interior portion of a large drop of latex has not perhaps properly coagulated, and hence at times this rubber sometimes fetches a penny less per lb. Formerly mat rubber used to turn black and did not fetch so much.

Latterly I ordered the mats to be soaked in a solution of the bark that comes off the tree in tapping. This dyes the mats red. The white latex when dripping down seems to be tanned by this dye on the mats in a similar way to that in the cuts where latex rests and coagulates. The reason for early coagulation is perhaps due to this tannic acid effect of the bark on the sides of the cut and the dye on the mats. The "mat" rubber we export is mostly red. Of the whole outturn of our plantations, some 15,000 lbs. last season, the proportion of "mat" rubber to that collected from the cuts as coagulated very elastic rubber was only 25 per cent of the whole outturn. The method of collection seems therefore as good as can be devised. Of course it is more costly to win this latex from the *Ficus elastica* than it is to win latex from the Para (*Hevea brasiliensis*) tree owing to the fact that the men who operate have to climb the trees twice to get the rubber.

CAMP DARRAGAON,
GOALPARA DISTRICT :
The 6th April 1905.

E. S. CARR,
Conservator of Forests,
Assam.

THE GREAT FROSTS IN NORTHERN INDIA IN 1905.

The very exceptional cold of the present season in India seems to have attracted a good deal of attention, and I have seen it stated that it is probably the severest cold that has occurred for perhaps 100 years. It may be interesting therefore if I mention two instances of excessive cold that occurred to myself during my tenure of office as Conservator of Forests, Central Provinces. The first case was in January 1860, after Lord Canning's visit

to Jubbulpore. After the Viceroy's camp broke up about 20th January, I marched east *via* Sohaypur into Munola, when the whole of the vegetation, which was partly grass rhumna and partly scrub jungle, was covered with a thick coat of hoar frost, just like a winter morning at home. This occurred, I think, three days running, but one day was particularly severe. This was, I think, the only case I recollect of real hoar frost in the plains.

The other case was in the Melghat forests of the Taptee Valley in Berar, so late as March in the year 1864, when for about a week thick ice formed in all the vessels exposed in my camp, and I had to get up and sit by a camp fire because I could not sleep for the cold in the small pal tent I had with me and not too much bedding. Both localities are about 1,200 feet above sea level, as far as I recollect.

GEORGE F. PEARSON,
Colonel, late I. F. D.

THE MADRAS FOREST MEMBER'S TOUR IN ANANTAPUR.

In the January number of the *Indian Forester* an article was published on the Madras Forest Member's tour in Anantapur in which was repeated an incorrect statement taken from the Forest Member's report. I refer to the age of the "fences" of some of the reserves, which were not erected in the famine of 1876, but in the years 1885, 1886, 1887, and possibly later. Most of the walls were built while I was in charge of the district, and with one exception they were built round the poorest and most unpromising reserves I could find, and they were alternately praised and condemned by several Conservators; I have not seen any of the fenced reserves since 1887, but if some of them (the Gootoor reserve for instance) now contain anything in the shape of woody growth, it must, I think, be admitted as the moral effect of the stone wall, for until this was built there was not a headload of wood, green or dead, per acre on most of the slopes.

In the adjoining district of Cuddapah somewhat similar walls were built in the famine of 1876 ; in many places the walls were barely two feet high and offered no appreciable obstacle to the wilful passage of man or beast, yet their moral effect was such that ten years later the growth inside the walls stood up like a six foot wall while outside the walls it was grazed, browsed and lopped to within two feet of the ground ; the reserve boundary was visible from a distance of fully three miles owing to the clean line of untouched growth.

SALEM :

29th March 1905.

F. LODGE.

REVIEWS AND TRANSLATIONS.

REVIEW OF THE FOREST ADMINISTRATION IN BURMA 1903-04.

There has been considerable progress in the forest administration of Burma during 1903-04 in spite of the increasing difficulties experienced owing to the inadequacy of the controlling staff and the weakness and frequent incompetency of the subordinate staff. The area of reserved forests was increased during the year from 19,709 square miles to 20,038 square miles. Demarcation is also being kept well up to date, 513 miles of new reserve boundaries being demarcated during the year. It is to be regretted that owing to the paucity of trained officers progress in Working Plans has not been so satisfactory as it ought to have been, only four parties having been at work instead of the eight parties prescribed in the programme of Working Plans drawn up in 1902. Considering that the area under working plans is at present a mere fraction of the total reserved area, that allowance will have to be made for annual increases in the reserved area for some years to come, and that before many years are over some of the earlier Working

Plans will come up for revision, the outlook is indeed a gloomy one.

Fire protection has, owing chiefly to an exceptionally short dry season, been unusually successful for Burma, the area burnt amounting to slightly over 6 per cent of the total area attempted as against 23 per cent during 1902-03.

The area attempted was increased from 4,744.652 acres to 5,216,560 acres. The all-important subject of the effect of prolonged fire protection on the natural reproduction of teak has been touched on in the reports of all four circles. The opinion appears to be gaining ground among Conservators and Divisional Officers that under certain conditions fire protection is highly antagonistic to successful teak reproduction; what the precise conditions are is not clearly stated, though it is generally agreed that in so-called moist forest the injurious effects are most marked. A quotation from the report of a Conservator schooled to the beneficial effects of fire protection in India, and who has but recently been transferred to Burma, may in this connection be not inapt—"In moist forests which have been under fire protection for a length of time the state of affairs is unsatisfactory in the extreme. The longer such forests are protected the denser becomes the growth of the various bamboos and of inferior species, and teak seedlings cannot and do not survive even if they establish themselves." This is a subject which we confess we should like to see probed to the bottom. The circle reports are not wanting in plain outspoken opinions by various officers whose reputation and experience can hardly count for nothing, and it is but right that their opinions should be duly weighed. The only satisfactory solution of the difficulty would appear to be to conduct practical experiments and record observations in a systematic manner and on an extensive scale; this can be practicable only if carried out by one or more officers on special duty.

Turning to artificial reproduction, we find that *taungya* plantations (chiefly teak and cutch) were extended by some 3,500 acres, almost exclusively in the Pegu and Tenasserim Circles. The total area of teak and cutch plantations in the Province is not

given, but the area in the Pegu Circle is stated to be 65 square miles, the plantations being dotted about the forests in more than 3,000 blocks. We are not surprised at the Conservator's remark that "the efficient supervision and up-keep of these plantations is far beyond the power of the Divisional Staff, and some of the plantations bear signs of having suffered for want of attention for many years past. This is extremely regrettable considering the enormous value of these plantations, which, acre for acre, probably surpasses that of the best plantations in Europe." We feel inclined to look askance at the extension of plantations when so little is done to improve the natural teak forests of the country, important operations such as climber cutting and improvement fellings having been carried out over an infinitesimal proportion of the area of reserved forests. It is satisfactory to note that experiments for ascertaining the best means of inducing and assisting teak reproduction have been started in more than one Division. This is a subject on which our knowledge is very incomplete, and while applauding the efforts of those officers who have devoted much time and energy to the matter, we venture to think that many experiments are foredoomed to failure for want of continuity of action when transfers of officers are frequent, and that such experimental work could best be dealt with by a special bureau.

A successful floating season has resulted in larger deliveries of teak than in the case of the previous year. The extraction of other timber shows steady development, although the development is retarded for want of good means of communication. The number of teak trees girdled was 66,550 as compared with 60,475 in 1902-03. The total outturn of timber and fuel during the year was 48,547,381 cubic feet, while the total value of minor produce extracted was Rs. 4,48,260. The gross forest revenue of Burma for the year was Rs. 85,19,404, the expenditure Rs. 35,00,311, and the surplus Rs. 50,19,093; the surplus is thus 59 per cent of the gross revenue. The surplus for 1903-04 is nearly 12½ lakhs in excess of that of the previous year, the increase being due chiefly to a good floating season combined with a rise in the price of teak.

The Conservators again lay great stress on the need for strengthening all the branches of the service. Schemes for the formation of new divisions, the reorganisation of the service, and the appointment of a head administrative Forest Officer for Burma have, we understand, been under consideration. Until these schemes have been fully considered and finally sanctioned some time must necessarily elapse, while the paucity of officers will be felt for some time after the new appointments are sanctioned.

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

KHEDDAH OPERATIONS IN BURMA AND AFTER.

In 1902-03 the Kheddah Department started work in Burma, in the Katha district, and captured about 250 animals. The Katha district is mainly composed of a wide valley down the centre of which runs the railway; on either side of this are, in many localities, huge expanses of flat ground stretching away to the foot of the hills. In former times these were cultivated fields, but for years past they have been covered with tall elephant grass, and have formed the home of the elephant, bison, sambur, pig, etc. Roads there are none. The only means of getting from village to village was to follow one of the numerous elephant paths through the grass. This grass usually burns in the hot weather, but in the abnormal season of last year the rains broke so early that little, if any, of the grass was burnt, with a result that this year it is almost impenetrable. Certain villagers have now petitioned the Deputy Commissioner that they are unable to move about the country owing to there being no wild elephants to open up paths. This is a result of Kheddah operations that would hardly have been anticipated, and it would be interesting to know if the same had been observed in India. But it is not only the people that have been inconvenienced. Bison and other game that used to wander along the elephant paths have this year almost deserted these plains, and unless there is a good

burning next hot weather these favourite shooting grounds may be permanently injured.

CAMP :

H. S.

16th January 1905.

[We feel sure that our readers will join us in our feeling of deep and sincere regret that this is the last article which will appear under the initials of H. S., well known throughout Burma as those of the late Herbert Slade, Conservator of Forests.—*Hon. Ed.*]

A HOLIDAY IN CALIFORNIA : LETTERS FROM T2.

THE YOSEMITE VALLEY, CALIFORNIA.

The Yosemite Valley is a wonderful place. Imagine a ditch 7 miles long and two broad with perpendicular rock walls 3,000 feet high. We had two days staging to get out here, first 44 miles with 6 lots of horses, and next 26 with 3 lots. The Americans, as a rule, do the round trip in four days ; such a rush that most get back dog-tired and disgusted. A quarter of the road is oiled, the rest is terribly dusty, and the jolting is awful. This stage riding is a great experience. It is wonderful how they get through and nothing breaks down. At the half-way place I spent a day seeing the big trees, *Sequoia gigantica*. They are magnificent. Near Santa Cruz, on the sea coast, where we have been staying, I also saw the other kind--the smaller common kind, *Sequoia sempervirens*. My friend's fruit ranch (peaches and grapes) is in the hottest part of California ; the usual daily summer maximum is over 100°. People work all day in that heat and with only a light straw hat and yet sunstrokes are very rare indeed. It is so dry up here in the Yosemite ; we are 4,000 feet high and the temperature is very nice. The trees here are just such as one has read about. Bushes of Chapparal, Manzanita, Buckeye, Sage, Nut Pine below. Higher up Yellow Pine, Sugar Pine, Red Fir, Incense Cedar. These are splendid trees. Near Santa Cruz I visited one saw-mill, and here on the way up passed near another, which I hope to visit. For the last two months the papers have been full of forest fires. One near Santa Cruz burnt down five saw-mills, and that was not half the damage done. They were engaging men anywhere and everywhere at

a dollar and a half an hour—six shillings an hour. Put that into rupees! These are of course bush and tree fires, not just ground or leaf ones.

This country is a very expensive one to live in; the smallest coin in general use is 5 cents, *i.e.*, $2\frac{1}{2}$ pence. On a ranch it is of course more economical, but there you have to do everything for yourself. Hired labour is so expensive.

People talk about red tape in India. It seems pretty bad here. We had an awful experience of the Customs. They are worse in San Francisco than in New York. They opened every box and fussed about little things, and said we visitors had to pay duty on them because they were still in the shop paper, and after all this bother, the duty was very little more than what we had ourselves first declared. Again, on the Railways when you get a reduced tourist return ticket, you have to sign your name on the ticket, and if the clerk cares to enter it there are printed entries on the margin for sex, size of body, colour of eyes, hair, age.

All this apparently is the result of so many big swindles. There are people so sharp and there is such a rush after the dollar, there is often also so much suspicion, and rightly too, of any official's conduct that he *dares* not use his own judgment. It really amazes an Englishman to see what libellous articles they have in the papers, and leading articles too, and giving details of names, etc. But there is no doubt about the people working hard and getting through their work quickly.

If you ever travel round this way home, I should advise you certainly to go *via* Vancouver. From all accounts the Empress boats are much more comfortable. On the Pacific Mail everyone complained about the food, and fancy the "Mongolia," a hot climate Phillipine boat, had no iron windsails for the cabin portholes. The Americans get things done or "through" as they call it, but they are a bit "casual" about it.

THE SAN JOAQUIN VALLEY.

My friend's ranch is a vineyard in the San Joaquin Valley between the coast range and the main hills, and lying about half

way between San Francisco and the south border of the State. He also grows peaches and oranges. All the land about here is irrigated. For watering cattle and also domestic use, the people here make great use of aerometers for a supply of water. They are not expensive, the chief cost being the cistern in which the water is stored, and the height at which the cistern is placed. Having water laid on through the house is a great convenience. It is also a great help for the garden, and very useful in case of fire.

A friend in the Royal Engineers has also been here. About a month ago we two went down to the south border of California on a visit to a mutual friend, who is working a "half section" as it is called here, *i.e.*, half a square mile. His land actually touches the Mexican boundary at a place called Calexico, just over the boundary being Mexicali. Both names are made up from California and Mexico. The land round Calexico is all desert, "The Colorado desert," or rather was. Within the last six years water has been brought in from the Colorado river to irrigate nearly a thousand square miles in California alone, and in Mexico, just south of the border, there is another thousand which can also be so treated. We had thus a good example of an American "boom," and a solid boom too.

It is a fine irrigation work, but there is nothing wonderful about it. The land is beautifully level and slopes back north till it is 250 feet below sea level. It is plainly the bed of an old sea—very fine clay earth full of tiny shells, with old sea beaches sloping down from the hills all round.

Our host is mostly engaged in raising cattle and hogs. He has now become quite American and a typical cow-boy, tall and lean. Says "yep" and "nope" for yes and no. He took us for a week's shooting trip into Mexico. He and I rode on the "buckboard," which also carried all our outfit, and the sapper rode. We also had another man and his wife on another buckboard. None of us had before been on this road, which was all through the desert. After going all day we struck water, and concluded to pitch camp, but the water was salt. We were very nearly making a dry camp,

and I had visions of my bones being left in the desert. However our host urged on his mules with his "gee-hup, Pete," etc., and soon we found ourselves in an inferno, which in Japan would be called "Big Hell"—bubbling mud volcanoes and boiling sulphur springs with apparently nothing but salt lakes to relieve one. Finally just after dark we got to fresh water and a camp of Americans staying here for their rheumatism. We moved camp next day, but while packing up suddenly saw two of the other man's horses loose and trotting home. Our host jumped on quick and rode back, but had to go six miles off before he could round them up. That day we slept near a camp of a big American Cattle Company, which has rights over a thousand square miles in Mexico. The country down here was more bushy, the principal growth being "Mesquite," which has a very strong resemblance to the Cutch (*Acacia arabica*) tree in Burma. We had two days' very good quail shooting, but deer we could not find. The second day we had another experience of the desert and its way. The R. E. man got lost. Next morning we hunted for him, but he came in himself before mid-day. He had been lost a whole day, had reached the river about sunset, did not know if camp was above or below, made a fire, and spent the night cooking quail and himself alternately. The trip was a great contrast to Indian camping. We of course had to do everything ourselves, had no bedsteads, but had to sleep on the hard ground under the sky. This in November! The early morning was cold, but the desert air is so dry, there is no dew. The winter climate here is perfect—beautiful clear sky with not a cloud. On this trip the cooking was done by my American friend. He was especially good at the American breakfast dish—hot cakes. An American thinks nothing of eating 15 to 20 of these each morning, so it is not wonderful if he suffers from the common complaint—indigestion.

Our host of course showed us how to lassoo. One day the R. E. went out on foot to catch a horse and did make a splendid throw, catching the animal round the neck as it rushed past. He hung on tight, so tight, that next moment he was on his head and had to let go again. However, he caught it eventually.

EXTRACTS FROM OFFICIAL PAPERS.

THE FIBRE OF HIBISCUS TILIACEUS AND OTHER PLANTS
AS SUBSTITUTES FOR JUTE.

An article on "Jute in Burma" having appeared in the *Rangoon Times* of the 25th August 1904, my attention was invited thereto by the Local Government, and a report was called for. With the approval of Government I send you the following account :—

OCCURRENCE OF HIBISCUS TILIACEUS IN BURMA AND REPORT ON THE
SUBJECT GENERALLY.

Hibiscus tiliaceus (Burmese *Thinban Shaw*) belongs to the natural order Malvaceæ and is allied to the cotton plant, to which its flowers bear a close resemblance, both having large bright yellow petals with a claret-coloured centre. It is plentiful in Lower Burma, generally along the tidal rivers and creeks, and this would seem to show that it thrives best on a saline or moist soil.

FIBRE.

The *Thinban Shaw* yields a fibre of average quality, which is probably more durable than jute if subjected to wetting, and would consequently do better for sacks which may have to stand on damp ground. It is a matter for planters or Government to decide whether its cultivation at the present day would pay better than that of other crops. In the case of China grass (*Rhea*) the manufacturers expect the cultivators to produce the raw material in large quantities before they will guarantee a high price for it ; yet the pre-eminent qualities of this fibre are well known. With a less famous fibre, as the one we are now considering, desultory experiments are not likely to attract capital. An experiment of this nature has been tried by Mr. Le Fevre, but was discontinued evidently for want of sufficient capital. It takes time for the special qualities and the most suitable mode of treatment of a new fibre to be learned by manufacturers who may have to order special machinery for dealing with it ; consequently

producers must be prepared to wait for profits until the produce they offer has not only established itself in the estimation of buyers, but taken a firm hold of the market.

LOCAL MANUFACTURE OF GUNNY BAGS.

It is quite probable that the Thinban Shaw or other suitable fibre would pay if the plant were cultivated and the fibre locally manufactured into gunny bags which are so largely required in Burma by the paddy and rice trade. It has been suggested by the Editor, *Rangoon Times*, that this might be done by hand looms in the villages, but owing to the want of enterprise and industry on the part of the inhabitants this is doubtful. Government might, however, grow the fibre or buy it from the cultivators and make it up into gunny bags at the jails.

VALUE OF THINBAN SHAW.

If this fibre were sent to market in the condition that jute is usually sent, it would probably fetch about £12 per ton or perhaps a little more. From the account given by Mr. Le Fevre he was offered £20 to £35 per ton. His specimens may possibly have been prepared with more than ordinary care, and thus have obtained higher quotations for a more highly finished article than the ordinary Calcutta jute. In fact, I am informed that he has a secret method of treating the fibre. He states that he worked it up into rope, matting, and gunny, and also dyed the fibre in different colours. Unfortunately he could not supply me with samples. The prices obtained by Mr. Le Fevre are very high, even at the lower quotation of £20, as the length of the staple was only 4 to 5½ feet, whereas Bimlipatam jute is said to average 7 feet and Naraingunge jute (the real article) 8 feet in length. It would no doubt be possible in cultivation to obtain Hibiscus fibre up to 8 feet in length.

NATURE OF THE CONCESSION GRANTED TO MR. LE FEVRE.

Mr. Le Fevre, who now resides in Rangoon, was granted a free permit to collect the fibre from July to December 1900, in the unclassed forests of the Toungoo district. In October 1900 he

applied for and was allowed an extension for one year. Nothing further was heard of the venture until I saw Mr. Le Fevre's letter in the *Rangoon Times* of 31st August 1904. I have since been informed that altogether 2½ tons of fibre were cleaned and prepared by manual labour and disposed of through Messrs. Finlay Fleming, Edmund Jones and Deacon Clarke, of Rangoon. The price realised is said to have been £35 per ton in England or Rs. 5-8 to Rs. 6 per maund in Calcutta. Mr. Le Fevre was obliged to stop work as the help which he had been promised was not forthcoming.

OTHER PLANTS YIELDING SUITABLE FIBRES.

HIBISCUS CANNABINUS, L.

The *Mesta-pat* of Bengal could be cultivated perhaps more extensively than Thinban Shaw, and in drier parts of Burma. This plant is already profitably cultivated in Vizagapatam district, Madras Presidency, and has been placed on the home market as a special kind of jute - Bimlipatam jute. (See No. 11, Agricultural Ledger, 1903.)

ABROMA AUGUSTA, LINN. E.

This sterculiaceous plant is mentioned on page 241 of the ledger referred to above. It grows in the Darjeeling Terai and possibly also occurs in South Tenasserim. It has not yet been met with in Burma by the writer and has apparently not been recorded from this Province.

VILLEBRUNEA INTEGRIFOLIA, GAUD.

(Kurz Flora, Vol. II, page 427, under *Orcocinde sylvatica* Miq.) The *Bonriha* of the Assamese. The Nepalese name of this is *Lipia* and the writer knows the fibre to be excellent.

MAOUTIA PUYA.

Wedd. (Burmese *Sat Sha.*) Kurz on page 429, Vol. II, says this is frequent in the drier hill forests of the Martaban Hills at 2,500 to 5,000 feet elevation, often springing up in deserted hill taungyas, and that it yields a strong fibre resembling rhea. The writer knows this fibre also to be exceedingly strong and durable. For gunnies and similar uses it should fetch a higher price than that paid for jute bagging.

GIRARDINIA ZEYLANICA. DENEVAR HETEROPHYLLA.

The Nilgiri nettle. (Burmese *Petragri*, Karen *Latsa*.) This is plentiful in moist places, *e. g.*, at Thagyo on the Kabaung river. The fibre which has been frequently reported on and exhibited, is very strong and durable and quite suitable for gunnies. The writer knows this fibre well and has had it made up into a coarse cloth, which is practically imperishable.

In the above list only those plants have been included which are not known to fame but which yield strong and durable fibres. If the gunny bag industry is successfully started the preparation of fine textile fibres and the utilisation of the waste tow, *e. g.*, for string, twine, paper-making, etc., is sure to follow. At the recent agricultural show of the Straits Settlements and Federated Malay States, held at Kuala Lumpor, it is said that a Mr. Schiemer has been very successful in preparing fibres by his new machine.

Mr. Le Fevre has been asked to prepare fresh samples of *Thinban Shaw* fibre for valuation as those previously prepared are not now available.

F. B. MANSON,

RANGOON :
27th January 1905.

Conservator of Forests,
Tenasserim Circle.

MISCELLANEA.

THE INDIAN FOREST SERVICE IN THE HOUSE
OF LORDS.

We reproduce the following extract from the *Pioneer* * since, whilst displaying the curious ignorance existing in the highest quarters on the subject of the training required by the Forest Officer, it at the same time affords considerable insight into the nature of the future training to be given to the recruits for the Imperial Service.

* Allahabad *Pioneer* March 30th, 1905.

In the House of Lords on Tuesday, the 7th March, the Earl of Lytton rose to call attention to the scheme at present under the consideration of the India Office for the removal of the Forest Department now at Coopers Hill to the University of Oxford, and to move "that in the opinion of the House the Indian Forest Service should be open to all the Universities of the United Kingdom." He said that this question involved an important principle, which was vital to the interests of the Universities. This principle was whether the right of admission to an important branch of the public service should be confined to one University endowed out of public funds or whether, as had always been the case in other branches of the public service, it should be thrown open to all candidates of Universities alike on equal terms. He sketched the history of the question, pointing out that Coopers Hill College was shortly to be abolished, that the School of Forestry there was to be transferred to Oxford, and that it was intended to hold an examination of all students at the end of the first year at the University. The proposals had aroused a great deal of hostility on the part of the authorities of other Universities, in the belief that they would be shut out from the opportunity of providing candidates for the Indian and Colonial Forest Service. The authorities at Cambridge had protested; and the Secretary for India stated in reply that it was considered essential that the Professor and Assistant Professor of Forestry hitherto entrusted with the work at Coopers Hill should be placed in charge of the training at the University, and that it was inevitable that one University, and not more than one, should be selected for the purpose of education. But the point of importance was whether or not it was essential that the necessary training for the Forest Service should be confined to one University alone. The protest which he entered was not directed against the selection of Oxford but against the selection of any one University to the exclusion of all others. The other alternative scheme which had been submitted involved the free and open competition of all educational establishments. The students should be free to choose their own University, go through the

ordinary three years' course, take their degree, undergo a scientific training at the laboratories and an examination finishing up with two years' practical forestry training in one of the Continental forests. By this scheme the public money obtained from the revenues of India would not be spent at one institution, and it was certainly believed that it was possible to devise a scheme which would be more in the interest of the service and fairer to all the Universities of the country. In conclusion, he assured the noble Marquis who would probably answer him that the feeling of hostility to the proposals in regard to Coopers Hill was not confined to Cambridge alone, but was felt by other Universities in the country, and that it was a very strong feeling. If no assurance was given that the decision would be postponed and further inquiry held, then the feeling he had indicated was sure to find some very forcible expression. He hoped that Parliament would refuse to sanction a scheme so unprecedented in character and which in its operation would be so manifestly unfair.

Lord Thring reminded their Lordships that a great deal of money had been spent in recent years upon improving Coopers Hill College, and said no one now could deny that it was extremely well managed and that everything in the College was satisfactory. In his opinion, it was for the benefit of the country that the College should remain at Coopers Hill. Why on earth they should destroy a good College in order to set it up somewhere else passed his comprehension.

The Marquis of Bath said there was a good deal of misapprehension both with regard to the reasons which influenced the Secretary of State in Council in formulating the scheme and also as to the results which would ensue from it. There had grown up throughout the United Kingdom a number of excellent institutions which were fully capable of carrying out that engineering instruction which Coopers Hill was originally founded to establish— institutions whose diplomas and degrees the Indian Government were prepared to accept. Further, the establishment of a forestry school at that College was no part of the original scheme. He particularly emphasised the fact that the scheme was, and was

intended to be, of a temporary nature. (Hear, hear.) In coming to his decision the Secretary of State in Council was guided by very strong representations that were made to him by the experts whom he consulted. They represented that the number of men who were engaged in the study of forestry was very small—only ten a year. It was considered most necessary that they should continue to be educated all in one place, and that a residential University should be found which provided rooms and particularly supervision for the students, and where they could be brought into contact with their contemporaries who were themselves at the same time studying for professions and other walks of life. Another advantage that was desired was that forestry students should obtain the benefit of instruction in auxillary departments of science and have the opportunity of obtaining University degrees or diplomas. In searching for a University of a residential character, and one not too far from London, the choice naturally lay between Oxford and Cambridge. No idea of preferring the one University to the other ever entered the minds of the authorities of the India Office. Indeed, when attention was first directed to the matter some two years ago, Cambridge was thought likely to be the most suitable place for the forestry school. But the experts in Indian forestry urged upon the India Office that practical teaching in forestry, involving visits to woods, must go hand in hand with theoretical instruction, and they pointed out that the situation of Oxford with respect to woods was far more favourable than that of Cambridge. There seemed to be an idea abroad that admission to the forestry school at Oxford would be of the closest kind. As a matter of fact the competition would be just as open at Oxford as at Coopers Hill, and the examination would be carried out by the Civil Service Commissioners. The one thing that the India Office required was that the students should continue their training at the University for two years and spend the last year of the course in Germany. But he desired again to emphasise the fact that this was merely a temporary measure. The revenues of India would not be spent upon a permanent establishment at Oxford or anywhere else until the matter

had been fully considered in the light of experience and of the best expert opinion. If it would meet in any way the objections that were felt to the scheme, he could undertake that an inquiry, which should include outside authorities, would be held before the close of three years to consider and report upon the experiment. Moreover, if it should be thought well to do so, the India Office were prepared to reduce the proposed experimental term of five years to three years; but they felt they could not reduce it below the latter period with advantage to the experiment. He hoped that the interest which had been aroused in this question would result in the establishment of institutions which gave teaching in forestry.

Earl Spencer said the subject was one of considerable importance. If they were not to maintain with regard to this question of forestry the general rule which had been hitherto adopted that all places of education should be able to send up candidates for the great Civil Services, they would be creating a bad precedent. He himself spoke, not only as a Cambridge man, but also as representing other Universities, of one of which, a northern University, he had the honour to be Chancellor. He could not see that the noble Marquis, in his clear and able statement, had furnished any argument why this difference should be made with regard to forestry. As far as he could gather, the Coopers Hill School was being practically done away with because it was found that in many places of education all over the country admirable teaching was given in various things taught at Coopers Hill. He could not understand, however, why it was necessary to require that the pupil students in forestry should all be instructed by one teacher. He thought that what Lord Lytton had said was perfectly true, that if they once established this school at a particular University it would be exceedingly difficult to remove it (hear, hear), and therefore an injustice would be done to a great many places of education. He could not understand exactly the comparison between Oxford and Cambridge with regard to special advantages in this matter. Although not an Oxford man, he had frequently passed Oxford, and it had never occurred to him that it was situated in the centre

of a great forest, and Cambridge, like Oxford, had within easy reach very large woods—in Bedfordshire, and even Northamptonshire, for instance. Moreover, Cambridge University held its own for scientific teaching with any place of education. He hoped their Lordships would agree to the resolution, as it was of great importance that they should not give an advantage to one particular University over another. He sincerely hoped the Government would not commit them to the new principle adumbrated with regard to the Civil Service.

The Marquis of Lansdowne said there was always a certain amount of animated rivalry in these competitions, which he was happy to think was always of a friendly description. He trusted that in the kind of private war which was proceeding between Oxford and Cambridge for the possession of these forestry students the rivalry would continue to be friendly. He might reassure the noble Earl opposite on one or two points. He could not help thinking that the amount of resentment which they were told had been provoked by these proposals was of a somewhat exaggerated character. What, after all, was the case? Coopers Hill College, for reasons into which he would not enter, because the question was not now before the House, had been put an end to; and it became necessary to consider what was to be done with that small portion of Coopers Hill students who had hitherto attended there for the purpose of studying forestry. They must be sent somewhere, and on the whole the Indian authorities had come to the conclusion that the University of Oxford offered the greatest facilities for the purpose. One thing seemed to him obvious—namely that this small handful of students could not be scattered about over a number of different educational establishments. The study of forestry was a highly specialised study and could only be pursued at places where particular educational facilities were forthcoming. It was for the authorities to consider, and with a perfectly open mind, whether they should send these students to Oxford or Cambridge. He was given to understand that when the proposal was put before the University of Cambridge the University authorities themselves admitted they possessed no particular facilities

for encouraging the study of forestry. He did not understand that that was merely due to the fact, although it was a fact, that the neighbourhood of Cambridge did not abound in those woodlands which were supposed to be desirable for the purpose of practical study. The result was this, that it had been decided to send this little body of some 20 students to study for a two years' course at the University of Oxford. The noble Earl was horrified, because he thought this arrangement was a blow at the practice of open competition; he could reassure him on that point. These students would be allowed to come up from any school or college, and they would gain admission to this forestry class by open competition, and open competition only. It was suggested that this was a dangerous discrimination in favour of one University at the expense of another. But what was the financial magnitude of this tremendous innovation? The whole expense of these forestry classes was to be borne out of Indian funds, and the only new financial element introduced into the calculation was a modest grant of £200 a year to the professor of entomology for a special course to the forestry students. This was an experiment which was to be tried for three years, and if the result fell short of expectation the whole question would be reviewed and an effort would be made to find some better arrangement. In these circumstances it would be somewhat violent for the House to take it upon itself to record its solemn disapproval of the proposals of the Secretary of State.

Viscount Goschen said that the real difficulty was the smallness of the whole operation. If there were 50 or 60 students they could be divided amongst several Universities. It was desirable that these students should receive technical education at an early period of their careers, and by getting them together the necessity of duplicating the teaching establishment was avoided. The noble Earl proposed in effect that there should be no school of forestry at all, but that special studies should be relegated to the close of the full University course. The choice lay between keeping the school in one place and scattering the students so widely as to have no professorial teaching in forestry at any University

Cambridge was not proposing to appoint a special professor. The whole quarrel turned on the possession of some ten men a year. For the next three years there would be forestry teachers at Oxford, and the University would endow a professorship, connected with a kindred subject. Nothing could be more deplorable than that a feeling of jealousy or resentment between the two great Universities should be aroused over this small question. Coopers Hill contained some 50 students, 40 of them engineering and ten of them forestry students. Cambridge would naturally capture the greater number of the former. Oxford might well be permitted to capture the latter.

The Bishop of Bristol said that the question was much larger than a dispute for the possession of ten men a year. It meant that all forestry appointments in India would be filled by Oxford men, when Cambridge ought to have its full share.

The Earl of Lytton said that if Cambridge captured the engineering students it would be in the open market. The question was not one of ten students a year. In a few years the students would number 50 or 60 a year. The necessary technical instruction could be given just as easily in Cambridge as in Oxford. If money were to be spent on the scheme in Oxford, it was futile to describe it as temporary. A protected interest would arise.

The Government were defeated on a division.

COOPERS HILL COLLEGE.

A year or so ago a suggestion was made in the pages of the *Indian Forester** that Coopers Hill should be maintained if not on its present lines then as a Forestry College for the Empire as a whole at which students from the Colonies could be educated as foresters side by side with those required for the Indian Empire. The *Pioneer*† draws attention to a modification of these proposals which has appeared in the *Times*, the modification consisting in the maintenance of Coopers Hill as an Engineering College and

* Vol. XXIX, No. 9, 373.

† Allahabad *Pioneer*, April 5th, 1905.

the formation of an Imperial Forestry College for the training of Forest Officers from India and the Colonies.

Although the question brought forward recently by Lord Lytton, in the House of Lords, with reference to the closing of the Royal Indian Engineering College at Coopers Hill, affects directly only the teaching of forestry, the principle for which he contended, says the *Times* in its engineering supplement, has an important bearing upon the whole problem of the selection and training of engineers for Public Works. One of the chief reasons assigned by the Committee of 1893 for the disestablishment of Coopers Hill College was that the Universities and other institutions of the United Kingdom had so far developed that they were able to supply men who in point of general technical instruction are suitable candidates for entrance to the Public Works Department of India; and the inference from the report of that Committee was that a specialised College like that at Coopers Hill was thereby rendered unnecessary. The proposal now is to establish a special course for forestry students for India at Oxford, which implies the provision of increased grants and facilities at Oxford for the purpose. If, as was suggested by Lord Lytton, Cambridge should succeed in attracting the engineering students for Indian Public Works, special courses, it may fairly be assumed, would have to be established at Cambridge for survey work and for Indian accounts. In like manner, if London or Glasgow secured the prospective telegraph officers for the Indian Public Works Department, local provision would have to be made for specialised instruction in the erection of aerial telegraph systems, survey, testing routine, and accounts applicable to the Indian service.

It appears, therefore, that the original statement of the disestablishment Committee that the Universities and other institutions are able to provide the necessary general instruction and training, has to be supplemented by the fact that there is no College, other than Coopers Hill, which is fitted to impart to such candidates the special knowledge necessary to render them efficient engineers for the Indian Public Works Department. Instead of abolishing Coopers Hill, the principal

Engineering College of the Empire, it might be wiser to extend it so as to enable it to provide specialised engineers, not only for India, but for every part of His Majesty's domains, where required for the Civil Service. Similarly, instead of establishing a mere seminary of forestry at Oxford for the ten or twenty students to which Lord Lansdowne referred, forestry might fittingly be represented by an Imperial College, at Oxford or elsewhere, from which men could be drawn for the development of that neglected branch for service wherever they may be wanted in Great Britain, India, or the Colonies. Lord Lansdowne regarded it as obvious that forestry students intended for India could not be scattered over a number of educational establishments, and Lord Bath emphasised the necessity of educating them all in one place, both for purposes of supervision and for the advantages which students derive from association with contemporaries studying for professions and other walks of life. This is equally true for telegraph and engineer students, and it makes the case for the retention of Coopers Hill College, on the lines laid down by Lord Curzon, and in accordance with the unanimous approval of the Government of India, stronger than ever. This opinion was confirmed by Lord Thring, who observed that it was incomprehensible that a good college should be destroyed in order to set it up elsewhere.

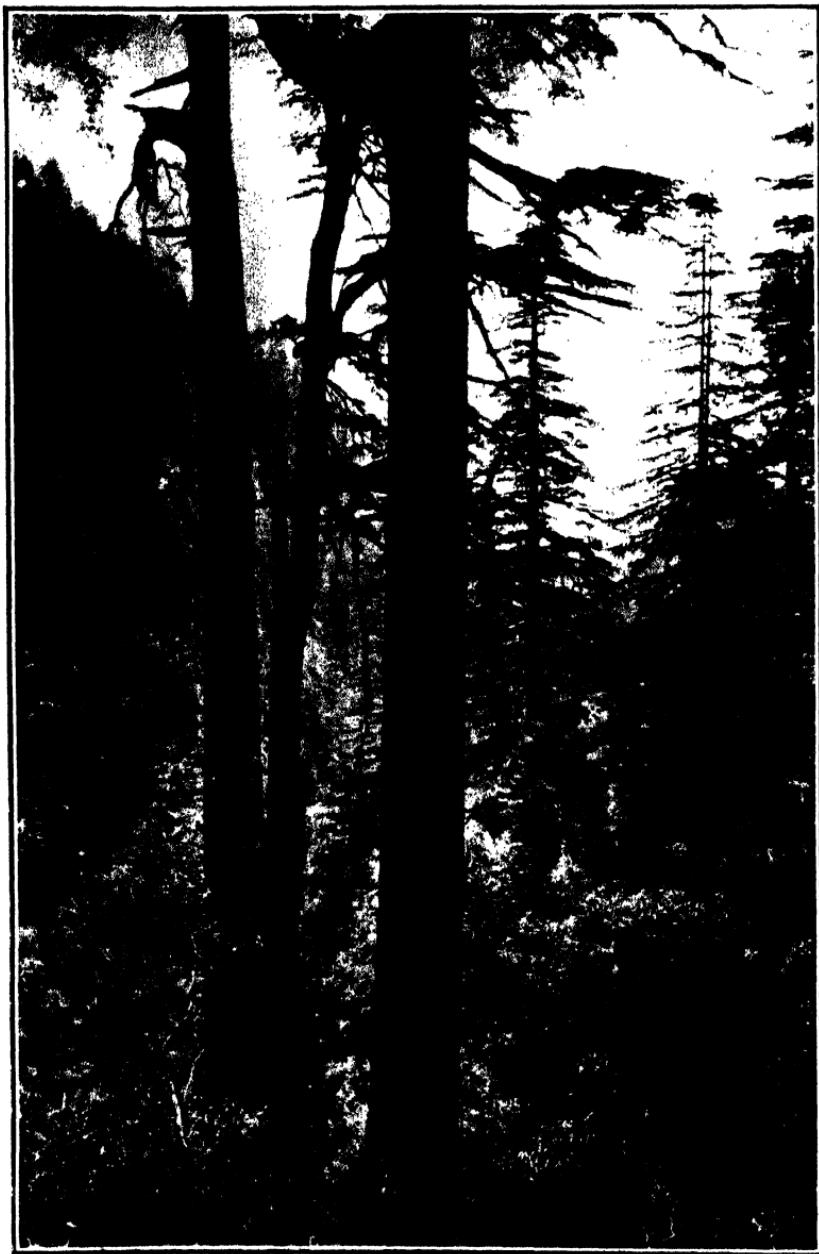
APPOINTMENT OF AN INSPECTOR OF GOVERNMENT ELEPHANTS IN THE MADRAS FOREST DEPARTMENT.—From papers recently received we are glad to note that the Government of Madras have sanctioned the temporary appointment of a Veterinary Inspecting Officer for elephants and cattle to the Forest Department. This officer will be under the orders of the Conservator of Forests, Southern Circle, but his work will from time to time be supervised by the Civil Veterinary Department. He will supervise the management and treatment of new captures as well as of the trained elephants working in the Circle, and his services will also be utilised in the selection of the bullocks or other draught animals that may be purchased by the Forest

Department. Mr. Mascarenhas, Senior Lecturer in the Madras Veterinary College, has been recommended for the appointment.

CANALS AND THE FORMATION OF PLANTATIONS.—The Punjab Government, not a bit too soon, says the *Indian and Eastern Engineer*, are seriously considering the wholesale damage done by cutting down timber before the advance of the canal irrigation in the Punjab, and have suggested to the Government of India that irrigated plantations be formed in the new canal colonies on the model of those existing at Changa Manga.

DESTRUCTION OF KHAIR BARK BY MONKEYS DURING THE GREAT FROSTS.—We have received from Mr. E. R. Stevens, Deputy Conservator in charge of the Dehra Dun Division, the following interesting note:—"This year the upper branches and at times the stems of the khair (*Acacia catechu*) are being stripped of bark by monkeys; it is probable that their usual food stuff has been destroyed by the heavy frosts and they have been reduced to take a hint from the porcupine below. Damage of this kind by monkeys has not been noticed by me before."

EXPORT OF DEER HORNS FROM CEYLON.—The export of deer and sambhur horns from Colombo still flourishes. The agitation raised by the Ceylon Game Protection Society some years ago against the exportation of cut and wrenched horns as distinguished from shed horns—deer and sambhur being ruthlessly slaughtered by organised gangs of Moor hunters for the sake of the horns principally—resulted in a slight falling off in the exports of a few years ago, but the "industry" is still very much alive. We trust that the Ceylon Government will take steps to put an end to this state of things before the damage done becomes irremediable. We would suggest that statistics be called for showing the number or weight of horns exported annually. From these it would be possible to arrive at the annual figure of slaughter. A high *ad valorem* export duty would probably meet the case to a certain extent.



DEODAR. 24 FEET GIRTH, DWANTI, TEHRI GARHWAL.

INDIAN FORESTER

JULY, 1905.

THE FUTURE TRAINING OF THE UPPER CONTROLLING STAFF OF THE SERVICE.

Cœlum non animum mutant qui trans mare currunt.

Even the most devoted partisan could scarcely maintain that there has been much continuity in action, although we are far from saying that there has not been continuity of purpose (or at least an endeavour that there should be so) in the matter of the education and training of the Controlling Staff of the Forest Service. In view of forest conditions in Britain this is, however, perhaps scarcely surprising.

It was pointed out the other day how sublime was the ignorance amongst the members of the Upper House on the subject of the commonest requirements and attainments necessary to the Forest Officer if he is to be rendered efficient to fulfil the important duties he will be called upon to perform. These services are, in their magnitude and in the almost incalculable results they will have upon its future history, of the very highest value to the State in which and to which they are rendered. From the very nature of the work, however, and from the localities in which it is performed and the immense time which has to pass before the results aimed at can be realised and enjoyed, it is above all others the least likely to receive notice either from the great bulk of the people for the benefit of whose posterity it is performed or from the State itself. That this is so is perhaps scarcely a matter for complaint, since in the silence of the forest work can be carried slowly to maturity which, exposed to the bright light of the open country and the hawk-eyed financiers, would perhaps not survive the present-day eagerness for visible results and quick returns.

The recognition which suffices for a service such as the Forest finds its realisation in the production of such results as, e.g., the Nilumbar Plantation, whose astonishing value has already been alluded to in this magazine. Those who inaugurated that work have passed away, but the plantations stand as a monument of their services such as probably few other pieces of work done at that period possess.

The Forest Department of the day must ever look to the future to proclaim its efficiency, and to ensure that that efficiency shall really arrive in due course it behoves the service to take the very greatest interest in the training accorded to those who will eventually take over the axe and the pruning knife.

Various have been the vicissitudes and much chequered has been the career through which the system of training has passed. France, Scotland, Germany and various combinations of all these were tried, and then the first step in the right direction was taken by starting an English School of Forestry at Coopers Hill. This has survived twenty years, and is now following its predecessors into the limbo of the past. That it has occupied so prominent a position in spite of all obstacles, and we all know that they have been many, has been entirely due to the energy, the tact, and unfailing courtesy and skill of its founder, guide, and head, Dr. Schlich.

That in a country in which forestry is so little understood as Britain changes were to be looked for is perhaps natural, but that they should have been as numerous as has actually been the case is scarcely a matter for congratulation, nor does it make for efficiency. Few would be found to deny that *esprit de corps* is not only a fine asset in a service but also a very necessary one. It is an illusory hope to expect its presence in services whose members have not that common tie and bond of sympathy which originates in the days of school or college and is unconsciously extended to predecessors and successors at the old haunts of play and training, but which never originates spontaneously in after-life. For this reason alone we trust that this restless wandering on the part of the Forest probationers in search of instruction may at length cease, and that to Oxford will fall the honour of building

up an English School of Forestry which will rank second to none in the world.

The University owes its capture of the Forest probationers to its own go-ahead initiative. We are in a position to state that the authorities met Dr. Schlich in the most friendly spirit and put every facility in his way to enable him to lay down the corner stone of the fabric whose subsequent elevation and decoration we shall all follow with such intense interest. It is no simple thing to pull to pieces a good college and rebuild it elsewhere. Under the present able guidance we have every belief that this will be done at Oxford. We hope to see in the fulness of time recruits from all over the Empire flocking to this centre; for the old reasons which made Coopers Hill a closed ring to the few, *i.e.*, want of accommodation and enormous expense, no longer exist, and a man will be able to study for the profession at Oxford on the same terms as his public school confrère for other walks in life. This is the first point which stands out with remarkable distinctness when the move from Coopers Hill to Oxford is considered, and it is one to which in the growing importance of the study of Forestry to the Empire at large the most prominent attention should be drawn.

We trust that the principle will be laid down from the commencement that the lectures are closed to none, for in that way alone will the future and full success of the new departure show itself. It is almost a truism to say that the larger the number of students in a college the better the instruction, because the better will be the men who impart it. Even more important is it to bear in mind that upon the magnitude of the scale upon which the new departure is made will depend its future success. Small beginnings when Government Treasuries have to be depended upon do not always have large endings!

We will now proceed to consider the changes which are to be initiated this year with the move from Coopers Hill to Oxford.

I.—THE QUALIFYING AND ADMISSION EXAMINATION.

That the examination for entrance as probationers for the Department has not, during recent years, either in its nature or

the method of conducting it, been such as ensured the selection of the best material is a point upon which none who have the best interests of the service at heart have held two opinions. To command success in a profession like Forestry a highly specialised and scientific training is necessary, and to ensure that the right men are in the first instance obtained it is necessary that they should have made an acquaintance with (and therefore probably have a liking for) the subjects which are subsequently to come into their future life's work *before* and not *after* their selection as probationers. Once a man has passed as a probationer he would need to be a strong one indeed and to have independent means (and the student is not usually in this position) to throw over on account of a dislike for science his practically assured appointment. We view therefore with the highest approbation the present arrangements.

Before being allowed to appear at the Admission Examination a candidate must have passed either Responsions at Oxford or the Previous at Cambridge or some one of the other examinations held (1) by these Universities, or (2) by the Universities of London or Dublin, or (3) by the Joint Board of Examiners for the Scottish Universities or the Scotch Education Department, or (4) by the College Entrance Examination Board of the United States of America, and recognised by the Universities of Oxford and Cambridge as equivalent to the Responsions and Previous Examinations, or must have passed an examination at some foreign University which in the opinion of the Secretary of State is at least equivalent to any one of the examinations above mentioned.

It will be noted that the above is necessary before the candidate is allowed to *appear* at the Admission Examination. The subjects at this latter are—

- (1) Mechanics and Physics.
- (2) Chemistry.
- (3) Zoology.
- (4) Botany.

Equal marks are given for each, and a candidate must qualify in each. Few will be found to cavil at this test, and there can be

little doubt as to the value of the article which the future probationer should be manufactured into.

2.—THE MEDICAL EXAMINATION.

The candidates who are provisionally successful in the competitive examination will be required to undergo a strict medical examination shortly after the results are disclosed.

3.—PERIOD OF PROBATION.

The period of probation, as is the case at present, will extend over about three years. The first two years will be spent at Oxford, where a special course of study will be followed and where the probationers will be expected to become members of the University, if not so already. The third year will be passed in receiving practical instruction, various continental forests being visited in turn. Excursions will also be made for the purpose of study during the first two years both in term time and in vacations.

4.—COURSE OF STUDY AT OXFORD.

The subjects comprising the course may be divided into two heads—

a. Subjects auxiliary to Forestry.

- (1) Elementary Organic Chemistry and the Chemistry of Soils.
- (2) Geology.
- (3) Forest Zoology.
- (4) Forest Botany.
- (5) Geometrical Drawing, Mathematics up to and including Plain Trigonometry, and Surveying.
- (6) German.
- (7) Engineering (Elementary).
- (8) Book-keeping in reference to Indian accounts.

b. Forestry, Theoretical and Practical, in all its branches.

a. The auxiliary subjects.—

The course in Geology will comprise two lectures a week, laboratory work twice a week, and in addition excursions.

In Forest Zoology there will be three lectures a week with laboratory work also thrice in the week.

The Forest Botany lectures will be delivered by the Sibthorpiian Professor. As the probationers will already have received a good grounding in both Botany and Zoology before they enter, there is every hope in the future that all Forest Officers will join with a good sound knowledge of these subjects.

As will be seen from the above list, Surveying, Geometrical Drawing and Simple Engineering are all provided for. We trust the course includes freehand drawing, although we see it nowhere specially mentioned. We are of opinion that instruction in free-hand drawing is absolutely essential to the Forest Officer, the subject being one which he will often find the use and need of in his after-life.

b. Forestry.—

The course of lectures will be the same as at present delivered at Coopers Hill. The same round of excursions to existing woodlands in England will be made, but there will be, it is hoped, an important addition. There is a nice wood of about 400 acres in extent just outside Oxford (Bagley Wood, belonging to St. John's College), and we hear on credible authority that Dr. Schlich hopes to be given the management of this forest; * in other words, that it will be treated as a School Instruction Forest, one of the most necessary parts of the equipment of a Forest College.

5.—THE PRACTICAL COURSE.

"During the third year of their probation—" we quote from the Regulations—"the students will receive practical instruction, visiting under suitable supervision such continental forests as may be selected for the purpose."

We trust that our remarks already made will have shown that we are in entire accord with the arrangements made for the theoretical part of the course. The new course will embody the best of the methods of tuition of the different Continental Schools, and we believe that it will in a very short time be difficult to obtain a more thorough knowledge of the Science of Forestry than will be procurable at Oxford.

* Since the above was written we understand that Dr. Schlich has been given the management of 650 acres of woodland situated 2 miles from Oxford —HON. ED.

Can the same be said of the practical course? It should be remembered that the men to whom it is being given are not going to spend their lives in England or in European forests. They will mostly go to tropical or semi-tropical ones, and will certainly also be working in immense areas—areas consisting of tropical vegetation. In a recent article in the *Indian Forester* an American Forest Officer practically led us to understand that he would advise Americans going to India for a practical course in preference to Europe. His point of view was, we think, very sound. "How is a man who is to practice extensive and perhaps even rudimentary forestry to learn his profession in a country where a thick population, a large peasant class, a paternal form of Government and a long-settled forest administration give the key to the instruction which he will receive and the principles which will underlie his forestry sense? How is one to learn constructive forestry in a country where forestry work is administrative routine?" It is of course a fact that a certain proportion of the work in India has become administrative routine, but we would venture to say on a very different scale and on very different lines to anything seen either in France or Germany. Formerly it was, as all will admit, essential that the practical course should be gone through on the Continent. Does the necessity still exist? Would it not be possible for the probationers to spend six months or a year at Dehra Dun doing their practical course in the country amidst conditions which, though not for all perhaps entirely similar to those of the part of the country they would eventually serve in, yet much more analogous than any they could find throughout the length and breadth of Europe? Would they not learn more by actual work in and tours through the Dun and adjacent United Provinces and Punjab plains forests supplemented by visits to and actual work performed in the Jaunsar and neighbouring Himalayan coniferous forests? We are of opinion that not only would the probationers themselves acquire a better and more thorough knowledge of Indian forest conditions as they actually exist, but in addition they would carry with them into other parts of the country, owing to the broader and more enlightened views engendered by the larger scale of operations and

forests among which they had had their practical course, ideas which would be of the utmost service in advancing the interests of the Department as a whole. Can it be doubted that we still as a Department suffer to a great extent from a certain narrowness of ideas induced by our practical course at home owing to the small areas and consequently minute ideas of working on which our training has been based? The Himalayas are not the only mountains, the only hills of any size in India, and yet outside the Himalayas are there many large systems of sledge roads, tramways, wire rope ways, water slides, &c., in India? Are such in common use for export operations in the forests throughout the country? Is it not conceivable that, had we all enjoyed even the advantages of such a practical course as is given to the students of the Dehra Dun School, the working of the forests would have been by now, in some localities, more intense? Have we not followed too much in the narrow and small European groove as if we were managing a few hundred hectares instead of charges of a few hundred or thousand square miles? We believe these queries can be answered in but one way; and we would ask whether the time has not arrived at which the question of the probationers performing their practical course under the eye of specially-selected experienced Forest Officers in India would not seem to demand careful consideration, and whether the plan would not result in a far better practical training than is obtained by placing them under specially-selected German Officers, admirable men no doubt, but with neither the local experience nor breadth of view of the Indian Officer. The plan would result in a saving, for the young assistant as he now joins is admittedly useless for the first year, which would not be the case had he gone through a year's practical work in the country. For the theoretical course the very best professors and the highest form of tuition attainable are required. Such can be only obtained at home, and above all at a University. For the practical portion of the training we are of opinion that it can now be best given in India. Whilst as a Service we owe much to our confrères on the Continent, and are scarcely likely to forget the debt, it should not preclude us from seriously

considering whether we have not been too slavishly copying methods which are entirely unsuitable to the very different conditions of affairs appertaining in India. To continue in the path will be to retrograde instead of to progress.

6.—THE DIPLOMA OF FORESTRY.

During the period of probation the efficiency of the probationers will be tested by periodical examinations. Those who satisfy the examiners at the end of the course and satisfactorily complete the practical portion thereof on the Continent will receive the Diploma of Forestry of the University of Oxford. It is also hoped that they will obtain a degree in the Honour School of Natural Science at the University. We would most strongly advise all probationers to endeavour to obtain this degree, since it will not unlikely prove of considerable use to them in their subsequent career in India.

We notice that the Government intend to make an allowance to each probationer, on signature of his agreement, varying from £50 to £100 according to the degree of proficiency and diligence shown by him during his practical course upon the Continent. As, however, under the new rules the young Forest Officer will have to pay his own fare out to India, he remains much in the same position as were the men before him.

SCIENTIFIC PAPERS.

NOTE ON THE OCCURRENCE OF A PARASITIC FUNGUS ON *PINUS EXCELSA*.

BY W. MAVES, F.C.H., I.F.S.

When working last autumn in a part of the Kaleda Reserved Forest in the Simla Division I noticed that a number of poles of *Pinus excelsa* had been attacked by a parasitic fungus, the fructification of which bore a close resemblance to *Trametes pini*, the well-known pest of the Scotch pine in Europe, with which those officers who have visited the forests of Prussia are doubtless familiar. Specimens of the fructification and of wood containing

the mycelium were sent to the Director of the Forest School, and were by him forwarded to the Cryptogamic Botanist to the Government of India. The latter officer has identified the species as *Trametes pini* itself.

This fungus is a true parasite, the mycelium growing in the interior of the living tree and producing red rot of the worst type. The wood becomes spongy and useless for timber, and exhibits numerous white-bordered cavities, the presence of which, as Dr. Butler informs me, is characteristic of *Trametes pini*, and of no other species. The spores obtain an entrance through wounds; and the sporophores appear on all parts of the tree-trunk, but show a decided preference for old branch-scars. They are bracket or horseshoe-shaped or rounded, generally small or of moderate size; and their colouration—blackish brown above and dull fawn below—makes them inconspicuous objects. My observations go to show that the mycelium lives in the heart wood rather than in the sap wood and cambium, with the result that, although the timber is rendered useless when once the fungus has obtained a firm hold, the tree is not killed quickly. This is in some respects a disadvantage, for it tends to give an infected wood a fictitious appearance of healthiness. For instance, the forest of which I am writing looks at first sight remarkably healthy and promising; and it is only when a closer examination reveals the numerous sporophores on the trees that the extent of the disease is realised. Fortunately *Trametes pini* does not attack the deodar at all, at any rate as far as my observations go. I have seen no instance of it, and the Range Officer states that he has not seen the characteristic red rot in the wood of any deodar tree that has been felled in the forest.

This occurrence of the fungus is of practical as well as scientific interest owing to the extent of the damage that has been and is still being done. Having been informed as to the identity of the species by Dr. Butler, I have lately made a careful examination of the affected area, with the result that a dense forest of *Pinus excelsa* poles covering an area of 181 acres has been found to be diseased beyond hope of recovery.

To obtain some reliable data I carefully counted the trees over an area of one acre in one of the best stocked parts, and found that out of 693 trees no less than 203, or say 30 per cent, were infected. These 203 trees were those which showed obvious signs of the disease in the shape of the sporophores of the fungus; but as *Trametes pini* does not fructify until its growth inside the tree is far advanced, there must be many more stems which are diseased but on which the sporophores have not yet appeared. Under the circumstances it is, I think, justifiable to assume that 40 per cent of the crop is already infected. Healthy and diseased poles are mixed together; the former have on them numbers of old branch-scars through which the spores can gain an entrance; and it is hardly to be supposed that any large proportion of the crop will ultimately escape infection. The only preventive measure that can be taken is to cut away every diseased tree as soon as the sporophores appear on it. If this were done it would mean cutting out nearly half the crop at once, and even then it is almost certain that the disease would not be extirpated. The poles are now about 40 years old, and in the ordinary course would have to grow for 40 years more to reach exploitable dimensions; but the balance of probability is that by the end of that time the great majority of them would be fit for nothing but firewood, even if they had not been thrown down by wind or snow owing to the spread of the fungus in the wood and the consequent rotting and weakening of the stem. Under the circumstances it seems that the only thing to do is to get rid of the present crop as soon as possible, and grow something better in its place; and I have already sent up official proposals for the conversion of the pine area into deodar. The method would be to make a severe thinning among the pine so as to remove about half the present stock, including if possible all the obviously diseased poles, and then to sow deodar in lines under the shelter of the remainder which would be removed gradually as the young deodar grew up. Under my proposals the sowing up of the whole area would be completed in 16 years, which is the period that the present working plan of the forest has to run.

I may add that I have lately observed *Trametes pini* in other forests besides Kalela, though not to the same extent. It appears that the fungus is an enemy to be reckoned with in all *Pinus excelsa* forests in the Simla hills; and it would be interesting to learn whether it has been observed in other parts of the Himalayas also.

ORIGINAL ARTICLES.

THE SCHOOL OF FORESTRY.

FOREST OF DEAN.

BY C. O. HANSON, L.F.S., RETD.

There has been so much written of late about the need for forest schools in England that it may be of interest to Indian Forest Officers to know what has actually been accomplished in this important matter by the Commissioners of Woods and Forests.

After the publication of the report of the Departmental Committee appointed by the Board of Agriculture to enquire into the state of British Forestry, the Commissioners of Woods and Forests determined to start a small school as an experiment. They decided that it should be in the Forest of Dean, as a large tract of woodlands was available for instruction and practical work. It was, moreover, decided that only working men should be admitted with the idea that, after going through the course, they would be suitable for the position of woodmen in the Crown Forests, or for woodmen or foresters on private estates.

The object of the school is to supply thoroughly practical men, not above doing manual labour, and, at the same time, with a thoroughly sound training in sylviculture. It was thought that such men would be useful both on small or large forest estates.

On the recommendation of Dr. Schlich, I was appointed Instructor, and the school was opened in January 1904 with a class of nine men of between 17 and 22 years of age. Seven of these were Crown workmen in the Forest of Dean and two were sent from Windsor Forest. In November 1904, a second class was

started with seven men, five of whom were Crown workmen and two came from private estates. In all there are at present 14 men at the school (two of the first class were found unsuitable and were dismissed). It is proposed to take in seven or eight men annually; the full course being two years. Each class attends school on two days in the week for three hours on each day, with an occasional full day in the woods on excursions or for practical work under my supervision.

The remainder of the week they are at work in the forest as ordinary labourers, and, though not then receiving instruction, they become fairly expert in much useful work. At such times they are employed on nursery work, planting, hedging, draining and the innumerable other operations which form part of the ordinary routine of forest work. In addition they are taught by experienced woodcutters to use an axe and saw.

With regard to class room work, I am the sole instructor, and the time at my disposal only enables me to deal with the most essential subjects. The majority of the men have done but little reading or writing since they left school at 14 years old, and a little general education, especially in arithmetic, would be an advantage; but until the school is enlarged and a second instructor appointed, it is impossible to do more in such subjects than to bring in what is absolutely necessary to render the lecture intelligible. If time permits the following subjects will be dealt with:—

1. Sylviculture, theoretical and practical.
2. Forest protection.
3. Measurement of felled and standing trees and woods.
4. Simple working plans suitable for the present state of the majority of small British wooded estates.
5. The felling and extraction of timber and preparing timber for sale.
6. Simple accounts and control books.
7. Elementary botany sufficient to understand the life-history of a tree, and the recognition of British forest trees and shrubs; the life-history of the more important fungi. The identification of the chief British timbers.

8. Entomology.—The life-history and identification of a few of the most injurious insects.

9. A short course of surveying.

The result of the first year's working is encouraging. The men are keen on the work, and have improved considerably in intelligence.

The school being in an experimental stage we have at present no school buildings or properly set-up class rooms. A room in the institute at Parkend, near Coleford, is placed at our disposal on school days. A small museum and herbarium has been started.

In course of time if the school is successful we shall probably be given proper accommodation.

The surrounding woods in the Forest of Dean, consisting of 18,500 acres, and especially the high meadow woods of 3,285 acres, which latter is now being worked under a plan prepared by the late Mr. H. C. Hill, afford ample instructional areas for the students to observe the growth of broad-leaved trees and larch. Unfortunately there are no woods of other conifers in the neighbourhood. There are a great variety of soils and situations, the land being hilly and varying from 100 to 900 feet in altitude and the soil being on four different geological formations.

... I receive much help from Mr. E. A. Popert, Conservator of Forests (retired), who is Superintendent Forester here, and every opportunity is given me of instructing the students in practical work, thinning, pruning, etc., by Mr. Philip Baylis, Deputy Surveyor, under whose general orders I work.

The future of the school largely depends on whether the students find places after completing their course. The Crown will employ a certain number, but, of course, cannot employ all besides those actually at the school. As we are continually hearing that trained woodmen are unobtainable in England, one may presume that there will be no difficulty in getting places for the passed students, and that employers will be willing to give higher wages than are at present given to untrained men.

It must be very satisfactory to Dr. Schlich to feel that, at

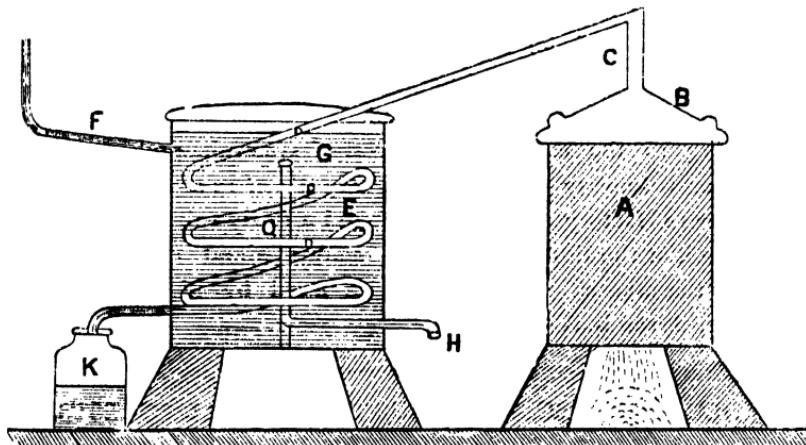
last, after his long continued efforts to improve British Forestry, a beginning, though a small one, has been made to educate the woodman class. It is perhaps hardly necessary to say that I have received a great deal of help and advice from him.

THE EUCALYPTUS (*E. GLOBULUS*) OIL FACTORY AT COONOOR, NILGIRIS.

BY K. G. MENOV, COCHIN FOREST DEPARTMENT.

This industry is carried on on a very small scale at Coonoor at the "Carolina" premises by Mr. Thomas Brown, the owner of the place

At present the industry is rather of the nature of an experiment than a lucrative business. The apparatus in use is comparatively simple, consisting of a still and condenser. The still is put up in a katcha building of small dimensions. A sketch of the still, condenser, &c., is given below. The still *A* consists of a big copper vessel of about 6 ft. in height and 3 ft. in



LONGITUDINAL SECTION OF THE STILL, CONDENSER, &c., USED AT THE EUCALYPTUS
OIL FACTORY AT COONOOR, NILGIRIS.

diameter and is covered by a disc *B* penetrated at its centre by a pipe *C*, which carries the vaporous oil to the condenser *E*. The

condenser is a copper vessel of about equal dimensions to the still and contains a coiled copper tube *D*, which is continuous with the pipe *C*, and also a vertical pipe *G*. *E* is filled to the brim with cold water by means of a feeder pipe *F*, the heated water from the condenser being carried away through the tap *H*. The jar *K* receives the oil condensed in tube *C*.

The still is filled with well-matured leaves and water poured in to fill up the interstices. The vaporous oil carried by tube *CD* gets condensed in its course through the condenser and trickles down into the bottle.

About two head-loads of leaves go to fill one charge of the still, and it takes usually about eight hours to extract all the oil of one charge. The resulting oil is, with advantage, re-distilled to drive away any aqueous vapour and pyroligneous acid present in it.

Since Mr. Brown uses his own firewood it is not possible to fix the expense incurred by him on that score. It may, however, be stated that as since about 20 c. ft. of firewood are consumed to extract the whole oil from one charge, fuel to the value of Re. 1-4-0 is usually burnt away. One charge of the still gives 27 oz. of oil. Besides the expenditure on fuel a sum of Re. 1-8-0 per charge of the still is entailed for supervision and rent of premises utilised for the purpose. Hence the total charge per fill of the still is Rs. 2-12-0, giving thereby 27 oz. of oil.

Owing to the extreme cheapness of Australian oil which in Madras and Bombay sells at Re. 1 per bottle of 12 oz., the oil of Mr. Brown's factory does not command a ready sale, so much so that he had, at the time I visited his factory, about 1,000 bottles ready for the market. The selling price fixed by Mr. Brown is Rs. 27 per dozen bottles of 12 oz.

GIRDLING OF MISCELLANEOUS TREES IN SAL FORESTS.

BY F. F. R. CHANNER, I.F.S.

Many readers of the *Indian Forester* must have experience of this sort of work and must have noticed that girdling appears to have no effect on several species. As it is a great waste of time

and money to girdle trees which cannot be killed in that way, it is of the greatest importance that reliable information on the subject should be arrived at and made public. Organized experiment is a necessity—casual observation will tell one that trees of such and such species have not died, but no proof is afforded that all other trees of the same species have not died. The observer probably goes home and issues an order about insufficient depth of girdling. Much might be done by observing that certain species never occur among the dead trees, but it is by no means easy to distinguish the species of many dead trees.

Experiments were conducted in the Bahraich Division of the Oudh Circle last season, and I make the results public in the hope that observations in other places may come to light, and that before long it may be settled once for all which species should not be girdled. Further information is required about many species, particularly about the rarer ones, as the numbers dealt with were too small for any decision to be arrived at.

Species which do not die when girdled.

<i>Dillenia pentagyna.</i>	<i>Eugenia jambolana.</i>
<i>Odina wodier.</i>	<i>Terminalia belerica.</i>
<i>Adina cordifolia.</i>	<i>Diospyros tomentosa.</i>
<i>Stephegyne parvifolia.</i>	<i>Mallotus philippensis.</i>
<i>Anogeissus latifolia.</i>	<i>Sterculia villosa.</i>
<i>Spondias mangifera.</i>	All species of figs.

Species which die when well girdled.

<i>Bridelia retusa.</i>	<i>Bassia latifolia.</i>
<i>Buchanania latifolia.</i>	<i>Terminalia tomentosa.</i>
<i>Augeinia dalbergioides.</i>	

Species which probably die, but more certain information is required.

<i>Kydia calycina.</i>	<i>Saccopetalum tomentosum.</i>
<i>Garuga pinnata.</i>	<i>Hymenodictyon excelsum.</i>

Species which probably do not die, but more information is required.

<i>Lagerstroemia parviflora.</i>	<i>Semecarpus anacardium.</i>
<i>Careya arborea.</i>	<i>Stereospermum suaveolens.</i>
<i>Grewia asiatica.</i>	
<i>Ulmus integrifolia.</i>	

Information is required about—Schleichera trijuga, Miliusa velutina, Gmelina arborea, Elaeodendron Roxburghii, Bauhinia racemosa, Bauhinia malabarica, Albizzia procera, Albizzia Lebbek, Cedrela toona, Cordia myna, Cordia vestila, Eugenia operculata. Many common species are omitted either because they are usually too small to come under consideration or because they do not actually occur among sal trees, but rather in patches from which sal is absent.

THE FIXATION OF SHIFTING SANDS IN MARWAR.

BY L. DAS, SUPERINTENDENT OF FORESTS, MARWAR.

Towards the north and west and south-west of Jodhpur the soil of Marwar is sandy, being a portion of the Rajputana desert. The sand is mostly of a shifting character, being blown across the country by the south-west winds of the summer, and frequently forms itself into hills of varying height. During the months of the year that the winds prevail, the blown sand is a serious nuisance in many ways, but chiefly on account of the great damage it does by spreading over the fields of the cultivator and the embarrassment it causes to the administration by accumulating on the Railway line and impeding traffic. To combat this latter annoyance the Darbar used to employ during the hot season a supernumerary gang of coolies to shovel away the sand as it accumulated over the line; but the arrangement was not only costly but at times unequal to the task of preventing frequent delays occurring to the traffic in cases where excessive accumulations of sand heaped up.

The nuisance is most felt in the area served by the Shadipalli section of the Jodhpur-Bikaner Railway, e.g., at Balotra station, where, although the line runs parallel to, and within a furlong of, the river Luni, the sand nuisance is hardly lessened owing to the bed of the river being dry for more than eight months in the year; on both banks the sand is almost as heavy as elsewhere. In 1901 the Marwar Darbar drew up measures to fight the sand by raising barriers against its progress. It was known that blown sand collects itself on the leeside of a barrier up to a certain height

and no further, and it was sought to train it so as to form a hillock which might gradually be consolidated by means of a plantation and forest growth. For the purposes of this experiment the belt of sand which divides the Railway line from the bed of the river Luni at Balotra was selected. A wooden fence being too costly, a 2 ft. high thorn-fence was placed immediately above the river bank and another a few yards short of the Railway line for a length of a quarter of a mile, similar fences being placed across so as to enclose about 20 acres of ground. The whole enclosed area was then strictly closed against the trespass of man and beast, the chaukidar even being forbidden to enter, lest he should break the soil and prevent the formation of a comparatively steady layer of rotten vegetation. Broadcast sowings were then made of *Babul* (*Acacia arabica*), *Khejra* (*Prosopis spicigera*), *Madar* or *Akra* (*Calotropis procera*), *Bhu*, *Baveli* (*Acacia Jacquemontii*), *Bhu*, *Rengni* (*Solanum* sp.), *Jharberi* (*Zizyphus nummularia*), &c. As soon as the fence on the river bank was covered with sand on the leeside, a fresh one was superimposed upon it; and this process has been repeated with the result that a ridge of loose or partially loose sand is now formed and promises soon to attain such a height that future sand drifts instead of crossing it will be beaten back into the river bed and washed away when the next rains come round. In the course of time, as the ridge becomes covered with wild vegetable growth and gains in firmness, it will form a fairly effectual barrier against the sand. Within the enclosed area beyond it is hoped by means of a growth of grass and shrubs to obtain a matted layer of roots and soil, dead leaves, &c., which will not only fix the sand but will enable more valuable species of trees to be put in and a valuable area of forest obtained, and thus for ever put an end to the nuisance of shifting sands near the Balotra station. The experiment in this double aspect has already been so far attended with success that the immunity of the Railway line from what at one time threatened to be an irrepressible evil seems assured; and the only pity is that during the last four years the rainfall has not been abundant enough to have already crowned the efforts of the Marwar Darbar with complete success.

SYLVICULTURAL NOTES ON HARDWICKIA BINATA.

FROM OBSERVATIONS MADE IN THE CUMBUM RANGE, KURNOOL DISTRICT.

BY E. M. CROTHERS, FOREST RANGER.

Hardwickia binata (*yepi*) is found in more or less all the reserves of the Cumbum Range. Various stages of growth are present from small seedlings to mature trees 6 ft. in girth, usually forming gregarious patches of large or small extent; in some reserves old isolated trees may be found amongst a thick growth of bamboos. A peculiar feature is that very few trees of 6 ft. girth are sound; this I should think is due to forest fires combined with the effect of a succession of dry hot seasons which must have caused cracks internally (cup and heart shakes), and as time went on these increased till the advent of fungi completed what drought and fire had left unaccomplished. In localities where excessive grazing has been going on for years on poor soil Hardwickia binata is represented by small stunted bushy growth.

Aspect.—I have seen Hardwickia on all aspects and doing very well so long as the soil is inclined to be sandy and deep; the underlying rock in all the reserves here is chiefly quartzite, which yields a reddish yellow gritty soil on which the growth of grass and other vegetation is not very profuse, and this seems to be the soil favoured by Hardwickia. I have never seen the tree growing in the immediate vicinity of streams, from which I infer that it does not care for much moisture in the soil, preferring rather a dry one.

Associates.—Hardwickia usually grows in a gregarious condition forming a pure crop, but in some localities it may be seen forming part of a mixed crop of many species, and on occasions it forms a very small proportion of the crop and is represented by old and hollow stems: on such areas I have not noticed many young trees. The only species in whose company Hardwickia forms a good mixed crop is *chiriman* (*Anogeissus latifolia*), the condition being that there must be only these two species on the ground (as occurs in some localities in this range). If advantage of this relationship between these two species

be taken, and if such localities where they are found together were to be put under special treatment by cutting out systematically all other species found on the area, it seems very possible that a crop could be obtained of these two species which could be treated as coppice with standards, the *Anogeissus* forming the coppice and the *Hardwickia* the standard; the latter would yield timber of large dimension whilst the former would give small sized timber and fuel.

Roots.—*Hardwickia* has a long tap root which runs down as directly as possible into the soil; in seedlings the roots are from two to three times the length of the portion above ground, though I cannot say definitely that this proportion is maintained in older trees; the tap root I should think is not very susceptible to injury because very often the sub-soil is full of loose boulders, large and small, and to make its way through these the root must often get injured; yet in such places *Hardwickia* seems to do well enough. To determine, however, exactly how much injury the tap root can stand would need a number of experiments consisting of cutting the tap root of a number of plants and watching the effects.

Reproduction by seed.—*Hardwickia* may be reproduced by sowings, if the seeds are deposited before the rains in a sandy soil with only a light cover of trees overhead. This conclusion I draw from the fact that when I was in the Ramallakota Range I noticed that before I began a felling in a crop of *yepi*, there were no seedlings on the ground (the fellings were conducted in February and March); the previous year's seeds must therefore have been on the area. After the rains when the coppice shoots began to sprout I noticed that there were plenty of seedlings as well, whilst in the unfelled area there were no seedlings, thus demonstrating that the cover (though light even there) was too dense.

The fellings provided that only eight of the best trees should be left per acre, which seems to suit *Hardwickia* reproduction by seed.

Coppice growth.—*Hardwickia* stumps throw up a number of shoots from about an inch below the cut surface of the stump; these shoots continue to grow up in a bush till one takes the

supremacy and the others then die down ; this could be aided by cutting out the unpromising shoots and leaving the best one of each clump to survive.

Enemies.—In dry seasons when the monsoons fail Hardwickia seedlings and young trees stand in imminent danger of being exterminated by cattle grazing in the forest, because at such seasons the little grass that does come up is soon eaten and then the hungry cattle turn their attention to Hardwickia leaves, which they seem to enjoy ; buffaloes more particularly prefer Hardwickia leaves to any other fodder.

Insects.—I have not noticed up to date any attacks of insects on living specimens of Hardwickia—not such as would damage trees to any appreciable extent ; the wood in stacks, however, is readily attacked by bark and wood boring beetles, more especially the white sap wood.

We trust the author will endeavour to procure specimens of these beetles for identification, since there are no reports extant of the wood being attacked by such and the observation is likely to prove of considerable importance. —HON. ED.

SOME LARGE DEODARS IN TEHRI GARHWAL.

BY J. W. OLIVER.

The two illustrations show specimens of particularly fine deodar trees growing on the right bank of the Dwanti stream in the Kulni forest, Tehri Garhwal, N.-W. India, where selection fellings were being carried out at the time the photographs were taken in May 1900. The deodars are mixed with Moro Oak (*Quercus dilatata*), which, while they have no doubt in a very great measure contributed to the excellence of size and quality of the existing crop of the former, render their reproduction a very difficult problem. The felling was followed by a good seed year, and at the end of 1902 there was an abundance of young seedlings on the ground. It seemed, however, doubtful whether they would be able to struggle through the undergrowth.

We have referred this latter point to Mr. Tulloch, the Officer in charge of the area mentioned. He has very kindly sent us the following note :—' The seedlings



DEODAR, 24½ FEET GIRTH, WITH MORU OAK, DWANTI, TEHRI GARHWAL.

referred to come up well, but only survived in places where there was no grass or Indigofera. I had several patches marked in the grass to see if the seedlings would survive, but found that by the next year they had all died.'—HON. ED.

CORRESPONDENCE.

FIRE PROTECTION IN THE TEAK FORESTS OF BURMA.

REPLIES TO MR. TROUP'S LETTER.

I.

It was with the greatest interest that I read Mr. Troup's important letter in the March number of the *Indian Forester* on fire protection in the teak forests of Burma.

As a Forest Officer who has put in over 15 years' service in Burma, and who in that time has naturally had large experience in both dry and moist teak forest, I at once hasten to confirm Mr. Troup's observations and remarks on the effect of continued fire protection in moist teak forests.

Mr. Troup has gone very thoroughly into the matter in his able article, and has, I think, proved that in the Kadin-Bilin Working Circle at least continued fire protection has, and is having, an adverse influence on the natural reproduction of the very tree above all others on which we pride ourselves so much in this Province. The result of the two countings made and the diagrams accompanying the same must have brought vividly to the eyes of many of your readers the futility of continued fire protection in moist teak forests like those in the Tharrawaddy Division. It is not in this Division alone that the same "terrible destruction," to quote Mr. Troup's emphatic but, in my opinion, true words, is going on. Many years ago I noticed the same thing in the Chaungzauk Working Circle of the Prome Division. That Working Circle had been for many years successfully protected from fire at the time I refer to. Though I made no countings, it was most apparent that in the area outside the reserve, which was not protected from fire, the natural regeneration of teak was infinitely better than inside the fire protected area. Not only were the "seedlings" very plentiful but young poles in about the normal proportion were growing and thriving in the area annually burnt over; on

the other hand, inside the reserve "seedlings" were conspicuous by their absence and most of the trees in the pole stage were either dead or in the process of being killed out owing to the shade of the bamboos—tinwa (*Cephalostachyum pergracile*) and kyathaung (*Bambusa polymorpha*). I do not remember now whether works of improvement had been carried on in the area alluded to, but the cutting of bamboos by license-holders was practised fairly extensively.

This latter is a most important point and one upon which Mr. Troup has laid due stress ; another point referred to by him but on which more stress might have been laid is the fact that in Plot A works of improvement had been carried out between 1875 and 1880 and again in 1898-99, and that during the first of these operations teak seed had actually been dibbled in over part at least of the area ; in other words, Mr. Troup has acted with the most extreme moderation and chosen as a plot on which to base his arguments one which had been most abnormally favoured in every way, one from which in fact figures inimical to Mr. Troup's purpose would have been expected.

Having contributed my own experience on this important matter I should like to state that I am not an anti-fire protectionist. With H. S. who has written in the same number of the *Indian Forester* I also "would urge moderation." My object in writing this letter is to show that at least one other Forest Officer in Burma agrees entirely with Mr. Troup's article, and I expect that many more do so. I only hope that they will let you know the result of their experience also.

In the dry teak forests where the prevailing bamboo is myinwa (*Dendrocalamus strictus*) and where the cover is much lighter fire protection undoubtedly does good in aiding the young plants to establish themselves. In such forests fire protection accompanied by judicious works of improvement is all that is required to improve the growing stock both in quantity and quality. I will go further and say that in such forests where generally there are seed-bearing teak trees scattered about such operations are in my opinion more natural, probably as effectual, and certainly cheaper than

taungya plantations and weedings carried on with an insufficient staff to supervise them. Plantations with fire protection as a *sine qua non* should be resorted to only where teak is absent or almost absent.

Another class of forests existing in Burma which would greatly benefit by fire protection is the In (*Dipterocarpus turberculatus*) and Mgyin (*Shorea siamensis*) forest. These forests are very dry and get, as a rule, burnt over twice or thrice every year. They have received but little attention in the past as the work of taking up, demarcating and attending to the more valuable teak forests was all that could be done by an already over-worked staff. These forests are generally on flatter ground and in more populous areas, and across them as a rule numerous rights of way exist, so that the cost of fire protection will be high; even higher than in the more distant teak forests where the danger from fire caused by the burning of taungya cultivation and by the carelessness of travellers is considerably less. Both the above-mentioned species are extensively used by Burmans for housebuilding, etc., and the existing stocks are being rapidly worked out. Luckily the natural reproduction is extremely good, but the annual fires do enormous damage. Successful fire protection even for a limited number of years would allow the existing "seedlings" to establish themselves, and I think more than repay in the long run even a necessarily high outlay on fire protection, looking at the matter merely from a revenue point of view.

THAYETMYO:

8th April 1905.

F. J. BRANTHWAITE,

Deputy Conservator of Forests.

II.

With reference to the interesting paper by Mr. Troup on the results of fire protection in the Burmese teak forests, I am writing to suggest that where the suppression of teak poles and seedlings is to be feared, cleanings of bamboos and inferior species which are associated with teak in these mixed forests may accompany fire protection. If such cleanings were made, teak seedlings and

poles would not be so readily suppressed. The light demanding teak suffers from its associates in the same way as oak in the north of France suffers from birch and beech. It is only by repeated cleanings of the latter that the oak is enabled to hold its own. Certainly these cleanings cost something, while the rough cleanings done by forest fires involve no expense to the State and no trouble to the officials. Cleanings in oak and beech forest also cost something, and so do cleanings of blue pine in deodar forests in the Himalayas. The blue pine saplings which are removed to prevent their oppressing the deodars are practically without value, and yet these cleanings have been carried on for years in the Himalayan forests. But there have been plenty of trained Forest Rangers in the north-west of India for the last twenty years, whereas I believe that trained Rangers are scarce in Burma. An insufficiency of trained Rangers may prevent the execution of such detailed work as cleanings. Only very rough forestry can depend on fires for cleanings, though Professor Wallace, in his book on Indian Agriculture, stated in 1887 "that periodical forest fires cause a natural process of healthy retardation, cleaning and thinning under which the magnificent forests of India have been nursed and produced." This was prophetic of the present ideas of many Burmese Forest Officers, who are doubtless overburdened with work, on account of the scarcity of trained Rangers. But Professor Wallace also advocated the extension of sheep and goat grazing in the Indian State forests and is not exactly a safe guide for foresters. It is time that Indian forestry should contemplate sylviculture of a more intensive character than that of its earlier days. Intensive sylviculture, however, requires the provision of a sufficient number of trained Rangers. The State supplies funds for plantations; surely it can also supply funds for Rangers to execute cleanings and thinnings, even if the produce of these operations is unsaleable, and the financial benefits that result must await the further development of the teak trees.

The tendency of forest fires is to produce and form more or less pure crops of teak, and it would be interesting to

know if teak timber grown in this way is as good as that produced in unburned mixed forest, where the teak trees are surrounded by shade-bearing species. In cleaned forests that are unburned all suppressed shade-bearing plants might be left under the teak and should certainly improve its growth just as suppressed beech improves the growth of oak. Teak grown in pure plantations in Assam and Nilambur has about $2\frac{1}{2}$ rings to the inch of radius while Burmese forest grown teak has about 12 rings to the inch. The faster grown plantation teak timber is, however, of less specific gravity and is probably weaker and less durable than the more slowly grown forest timber. I referred to this on page 100 of my rough notes on Indian Morphological Botany, published in 1888, but although Gamble's *Manual of Indian Timbers* (p. 529) refers to the much more rapid growth of plantation teak, it says nothing about the comparative qualities of plantation and forest grown teak. It would have been interesting if Mr. Troup had given the numbers of the teak trees over two feet in girth in the two plots he describes, but he is on the right track by publishing the results of actual observations instead of dealing in generalities.

COOPERS HILL:

W. R. FISHER.

April 24th, 1905.

III.

On this subject we extract the following interesting information from a letter recently received from Mr. J. W. Oliver :—

I have read Mr. Troup's article on "Burma Teak Forest" in the March number with very much interest, but I am not convinced by it and for the following reasons :—

In order to compare the two areas it is necessary to have a complete statement of *all* the trees on them.

2. I cannot exactly locate the plots he alludes to, but I know whereabouts they are, and I remember as far back as 1875 (when my head-quarters were for several months at Kywemakaing*)

* The areas enumerated were in the neighbourhood of the bungalow at this place.—HON. ED.

being strongly impressed by the fact that there were many more young teak trees in the forest immediately outside the fire line than in the fire traced area and regretting that the former had not been included. The comparative scarcity of teak inside could not at that time be attributed to fire protection as the latter had only just commenced ; probably the forest outside being nearer to the villages had for years past been more largely resorted to for the supply of bamboos, &c., and had consequently been kept more open.

3. At the top of page 140 he says of the unprotected area "owing to annual burning, however, the undergrowth of small sized bamboos, characteristic of fire-protected forest, is almost entirely absent." The two species of bamboos on the plots are said to be Tinwa and Kyathaungwa, and as the latter is said not to have flowered for over 40 years the young bamboos referred to must be Tinwa, which flowers sporadically. Now, I have never known an ordinary annual fire to destroy young bamboos ; it checks and retards their growth to a certain extent, but they come up all the same. I, therefore, infer that there must be a considerable difference in regard to the composition of the bamboo crop on the two areas. Probably the burnt area is mostly Kyathaung, and as this bamboo is the best for general purposes it would be much more largely cut over than the Tinwa on the protected area, which is not much used when other bamboos are available.

I have ever since 1881 advocated the use of fire for the purpose of obtaining the reproduction of teak in bamboo forests, but, as I have previously remarked, we do not always want to be regenerating the forests. I think Slade has written a very sensible letter on this point.

J. W. OLIVER.

MERCER'S TABLES OF THE CUBIC CONTENTS OF LOGS

As I have recently had applications for copies of my "Tables showing the cubic contents of round and squared timber" which cannot be met owing to the tables being out of print, I would be glad if any officers who require the tables would communicate with me direct, informing me of the number of copies that they

require in English, Urdu or Hindi, in order that the advisability of printing a fresh edition may be considered.

7th May 1905.

L. MERCER,

Conservator of Forests, Naini Tal, U. P.

THE POLICE COMMISSION'S REPORT AND THE FOREST SERVICE :

A COMPARISON.

The publication of the Police Commission's Report will doubtless lead to comparisons between the prospects of Police and Forest officers, much to the disadvantage of the latter who, although highly trained technical officers, receive nothing in the way of pay, or concessions regarding leave, length of service, etc., which is not obtainable by members of an untrained service. The course of training at Coopers Hill is said to cost a thousand pounds, which is borne entirely by the embryo Forest Officer or his parents ; on arrival in India, neither his pay nor his prospects are one whit superior to those of the young Police Officer who sat next him at the entrance examination, but the Police Officer has *not* spent £1000 on his training ; on the contrary he has received three years' pay and has put in three years' service counting for pension while the young Forest Officer has been absorbing instruction at Coopers Hill. And now that posts on Rs. 1,500, Rs. 1,750, and Rs. 2,000 are to be created in every Province, it seems probable that there may be some difficulty in recruiting the controlling staff of our Department in England. As with the European staff, so with the provincial service and subordinate staff. Superintendents in the provincial Police Service are to be given salaries of from 600 to 900 rupees ; Extra Deputy Conservators can never rise above Rs. 600 ; Police Inspector's pay is to begin at Rs. 150 ; Rangers begin at Rs. 50 ; constables are to get increments after 3, 8, and 15 years' service ; guards have no certainty of any increment. The best men will naturally go to the better paid department, and the forest will obtain men who are not good enough for the police.

If a Forest Commission had been appointed a great portion of its report might well have been a duplicate of the Police Report

with the necessary alterations of names. I enclose extracts from the summary of recommendations of the Police Commission modified to suit the Forest Department and, though fault may be found with some of the items, on the whole they cover most of the ground which Forest Officers wish to see covered. It will be noticed that the term "Deputy Conservator" is relegated to its proper place, corresponding with that of Deputy Collector in the Revenue Department and Deputy Superintendent in the proposed police establishment. Divisional Officers thus become Conservators, corresponding to Superintendents of Police, and Conservators become Deputy Inspectors-General; this alteration of nomenclature may be unimportant, but it is adopted in order to simplify the comparison between the Police and Forest staffs.

F. A. L.

FOREST REFORM.

REPORT OF THE COMMISSION.

SUMMARY OF RECOMMENDATIONS.

The following is a summary of the recommendations contained in the Forest Commission's Report:—

I.—ORGANISATION.

(a) — District Establishment.

That the Forest force should consist of (a) a European Service to be recruited entirely in England; (b) a Provincial Service to be recruited entirely in India; (c) an Upper Subordinate Service, consisting of Rangers and Deputy Rangers; and (d) a Lower Subordinate Service, consisting of the Foresters and Guards.

2. That the office of Inspector-General should ordinarily be held by a selected Deputy Inspector-General and that the Inspector-General in Bombay and Madras should be given the same powers as are exercised by Inspectors-General in other provinces.

3. That all the large provinces should be divided into circles and that a Deputy Inspector-General should be placed in full administrative charge of each circle.

4. That no officer of lower grade than that of Conservator should be placed in charge of the Forests of a district.

5. That a certain number of Conservatorships should be reserved for members of the Provincial Service.

6. That for some of the large districts in Madras, and for Khandesh in Bombay two Conservators are required.

7. That on the analogy of the Provincial Civil Service a grade of Deputy Conservator should be created; the status of these officers being the same as that of Assistant Conservator.

8. That there should be one Assistant or Deputy Conservator in every district, and that in the large districts one or more additional officers of this class should be appointed to hold charge of a sub-division.

9. That each district should be divided into circles, consisting, as a rule, of from 5 to 8 Forest Stations.

10. That a Ranger should be placed in charge of each circle to supervise all Forest work within it.

11. That the ordinary area of a Forest Station should be about 15 square miles of forest.

12. That the officer in charge of a Forest Station should be of the rank of Deputy Ranger, and that where the work is heavy, one or more additional officers of this rank should be appointed.

13. That one Forester should be attached to every station to perform the duties of station writer.

14. That the establishment of a station should also contain a second Forester to render general assistance to the Deputy Ranger but not to undertake the investigation of any offence independently of that officer.

15. That the duties of guards should be of a mechanical character, such as escorts, guards, patrols and the like, and that they should be employed on the more responsible Forest duties only under the direct orders of some superior officer.

(c)—*River Staff.*

27. That for the prevention and detection of crime on the navigable rivers a separate River Force is necessary.

(f)—*Criminal Investigation Departments*

35. That there should be constituted in each province a Criminal Investigation Department for the purpose of collating and distributing information regarding organised crime, and to assist in the investigation of crimes when they are of such special character as to render this assistance necessary.

II.—RECRUITMENT AND TRAINING.

43. That the recruitment of the European Service should be by competitive examination in England on the same conditions as at present, except that the age limits for candidates should be 18 to 20.

44. That successful candidates should be required to undergo a two years' course of training at an English residential University where there is a Board of Indian Studies, each candidate receiving an allowance during this period of £100 a year, and that the course of study should include Forestry, Botany and Indian Vernacular, Indian History, Geography, Mineralogy and riding and should be followed by a practical course in the French or German forests.

45. That in addition to this probationary training in England each Assistant Conservator should, on arrival in India, be attached for one session to the Provincial Training School.

46. That the Provincial Service should be recruited by the promotion of carefully selected Rangers.

49. That, save in exceptional cases, appointments of Deputy Rangers should be by direct appointment and that promotions of Foresters to this rank should be strictly limited, and should in no case exceed 15 per cent of the vacancies.

50. That probationers should be selected from a general list of candidates, compiled by the Inspector-General, from lists prepared by Deputy Inspectors-General with the assistance of Conservators.

51. That no person should be eligible for entry in these lists unless he is of good moral character and social position, possesses the necessary educational qualifi-

cation, which shall in no case be lower than the University Matriculation or School Final Examination, is between the ages of 21 and 25 years, and is physically fit for the Forest Service.

52. That a Provincial Training School should be established in each of the larger provinces for the training of Forest Officers of and above the rank of Deputy Rangers.

53. That the Principal of this School should ordinarily be a carefully selected Conservator assisted by a competent and adequate staff of Instructors.

54. That the course of instruction should include the elements of sylviculture, procedure and practice, and the habits and customs of the people; that arrangements should be made for giving practical training in field work; and that special instruction should be given in regard to the manner in which Forest Officers should conduct themselves towards the public.

55. That the recruitment of Foresters should be by promotion from the ranks except where it is impossible to find among the Guards a man qualified for the post of station writer.

56. That Guards should be recruited locally, so far as is possible; that recruitment should be confined to the classes which are usually regarded as respectable, care being taken to ascertain that the candidates are of good character and antecedents. Members of the criminal classes should not be enlisted.

57. That a due proportion should be maintained between the importance attached respectively to physical and educational standards with a view to increasing the number of literate men in the department.

58. That for the training of guards central schools should be established for groups of districts; that each school should be under a Deputy or Assistant Conservator assisted by a staff of Rangers and Deputy Rangers; that the course of training should extend over six months and should include instruction in drill, discipline, elementary law and forest procedure, and the manner in which Forest Officers should conduct themselves towards the public.

III.—PAY.

59. That the minimum pay of Guards should be fixed for each province or part of a province at a rate which will give a reasonable living wage for a man of the class required; that in no province should

this minimum pay be less than Rs. 8 a month, while in Burma it should be about Rs. 12.

60. That after three years of approved service the pay should be raised by one rupee per mensem, after a further period of five years by another rupee, and after seven years more by a third rupee. In Burma the increment should be Rs. 2 instead of one rupee.

62. That Foresters should be divided into three grades, carrying pay at Rs. 15, Rs. 20, and Rs. 25 a month respectively.

63. That Deputy Rangers should be divided into four grades on salaries of Rs. 50, Rs. 60, Rs. 70 and Rs. 80; that they should also receive a horse allowance of Rs. 15 a month, but no special allowance for the charge of a station; that while at school they should receive Rs. 25 a month and no horse allowance; and that they should be given a reasonable advance for the purchase of a horse, uniform and accoutrements.

64. That Rangers should be divided into four grades on Rs. 150, Rs. 175, Rs. 200, and Rs. 250.

65. That Rangers should receive travelling allowance at the rate of not less than one rupee per diem.

66. That Deputy Conservators should be divided into four grades, carrying salaries of Rs. 250, Rs. 300, Rs. 400 and Rs. 500 a month.

67. That Assistant Conservators should be divided into three grades on Rs. 300, Rs. 400, and Rs. 500 a month, respectively.

68. That Conservators in the Provincial Service should be graded on salaries of Rs. 600, Rs. 700, Rs. 800 and Rs. 900 a month.

69. That Conservators of the European Service should be divided into five grades, with salaries of Rs. 700, Rs. 800, Rs. 900, Rs. 1,000 and Rs. 1,200 a month; but that no Conservator should receive promotion to the Rs. 900 grade if he is considered unfit to hold charge of any of the more important districts.

70. That Deputy Inspectors-General should be divided into three grades on Rs. 1,500, Rs. 1,750 and Rs. 2,000 a month, respectively, and that these officers should be eligible for the special pension of an additional Rs. 1,000 a year provided for in the Civil Service Regulations.

71. That the pay of the Inspector-General in the larger provinces should be fixed at Rs. 2,500—100—3,000.

72. That free quarters should be provided for every Forest Officer of or below

the rank of Forester; the quarters now provided are in many cases unsuitable and in some instances are unfit for human habitation.

73. That all officers should be entitled to retire on full pension after 25 years' service, and that the Government should be empowered to dispense with the services of any officer after that period of service.

IV.—STRENGTH.

74. That the Department is at present inadequate in every province and must be increased.

75. That a reserve is required to supply men for the vacancies caused by casualties; that in the case of the European superior staff this should be provided in the rank of Assistant Conservator, while for the Provincial and Upper Subordinate Service it should be provided in the rank of Deputy Ranger and should be fixed at 14 per cent of the total strength of those services; and that for Guards and Foresters it should be provided by an addition to the rank of guards of 15 per cent of the total strength of both Guards and Foresters.

V.—DISCIPLINE.

76. That the District Magistrate in Madras should not interfere in matters of discipline, which should be left entirely to the officers of the force, but the Magistrate should have power to direct the Conservator to make an enquiry into the conduct of subordinate officers, and if he is not satisfied with the result of that enquiry he should be at liberty to bring the matter to the notice of the Deputy Inspector-General or Inspector-General.

78. That evidence of general repute should be admissible to prove a charge of corruption.

79. That removal from the Service upon reduced pensions or gratuities should be permissible in the case of officers who are proved to be inefficient.

VIII.—RELATIONS BETWEEN THE DISTRICT REVENUE OFFICER AND THE FOREST STAFF.

85. That Divisional Commissioners should not interfere directly in the details of Forest administration, but that their responsibility should be limited to the duty of supervising and advising Conservators.

86. That the responsibility of the Conservators for the administration of the district must be preserved, and that he

must, therefore, be given authority over the Forests; but that this authority should be of the nature of general control and direction and not a constant and detailed intervention.

X. - PROSECUTION.

114. That in every Sessions Division, and in every district where the Sessions Division includes more than one district, a qualified member of the local Bar should be appointed a Public Prosecutor for the conduct of important cases; and that such appointment should be for a term of years.

115. That for every district a Ranger should be appointed a Public Prosecutor for the conduct of cases in the magisterial courts; that he should be assisted, where necessary, by one or more Deputy Rangers; and that at the head-quarters of his magisterial sub-division a Deputy Ranger should be appointed as Public Prosecutor for the courts in that sub-division.

116. That the postponement and adjournment of cases causes grievous hardship to parties and witnesses and serious injury to Forest work.

117. That the scriptory work of Forest Officers should be reduced as much as possible, and that the statistical returns should be limited as recommended in the Appendices.

120. That Forest work should not be judged by statistics, but by local inspection and enquiry.

121. That Conservators should, as far as possible, be relieved of work in connection with accounts.

122. That miscellaneous work not connected with proper Forest duties should not be imposed on Forest Officers.

XI.—MISCELLANEOUS.

123. That there should be a single Forest Act for the whole of India.

124. That the Forest Manuals of every province require to be largely reduced in bulk, and that that portion of each Manual which is of general application should be prepared under the instructions of the Government of India.

125. That there should be greater uniformity of nomenclature as regards both the *personnel* of the Forest Department and its records.

126. That there should be periodical conferences between the Inspectors-General of the different provinces.

127. That the Government of India should supplement their occasional reviews of the annual Forest Reports by a quinquennial review of Forest work for the whole of India.

USE OF TERMS.

I have just been reading with great pleasure the new Dehra Dun Working Plan. The only trivial fault I find is the use of the terms *wounding the soil*, and *shisham*. I do not know who is the happy inventor of the former barbarity. It gives me the notion of a naked savage going about with bow and spear, jabbing holes in poor mother earth and neglecting to heal them with a seed. It is not English, and there are plenty of terms that are, such as *working (light or heavy)*, *hoeing*, *scratching*, *raking*, &c., *ad lib.*

As for *shisham*, I have always tried to reserve *shisham* for *D. latifolia* and *sissoo* for *D. sissoo*. We all know the two terms to be variants of the same, but it is extremely convenient to know which is meant when Latin is not used.

REVIEWS AND TRANSLATIONS.

FOREST TERMINOLOGY.

Forest Terminology.—*Vocabulaire Forester,—Forst—Terminologie.* By J. Gerschel, Professor of English and German at the National Forest School, Nancy. 4th Edition, 1905. Berger-Levrault & Cie., Paris and Nancy.

We have received a copy of the 4th edition of Professor Gerschel's Vocabulary of Forestry Terms, which comprises an exhaustive list of words and phrases employed in the different branches of forestry, and in the sciences connected with it, in French, English and German. The volume is of convenient pocket size, and contains 203 pages. As explained in the preface, this is the first edition in which an English vocabulary has appeared. Although its inclusion was contemplated in the second edition it was after due consideration at the time decided that the meagreness of the English language as regards technical forest terms was a bar to anything like a complete vocabulary. This objection, thanks to the recent spread of scientific forestry in India and in America, no longer holds, and the author has, with the help of Mr. W. R. Fisher, now succeeded in producing a wonderfully complete and most valuable list of English and American forest terms, with their equivalents in French and German. The utility of such a vocabulary to any English Forest Officer who contemplates a visit to the forests of France or Germany is at once apparent; we would, however, go further and say that the book should be in the hands of every forester who has the least desire to keep his technical knowledge up to date by the perusal of French and German publications. Not only is there a comprehensive list of forest terms in their more circumscribed sense, but the various important Botanical, Zoological and Geological terms, as well as hunting and fishing terms, will also be found. An accurate rendering of the various administrative charges and official titles of India into French and German is not always possible. This difficulty is occasionally

apparent in the vocabulary. Thus "Ranger" (India) is translated "Garde Général Adjoint" (French) and "Revier förster" (German) while "Assistant Conservator" (India) is translated "Inspecteur Adjoint" and "Forstmeister" (German). On the other hand, the equivalent of "Oberförster" (German) is given as "Range Officer" and "Assistant Conservator" (India). The German title "Referendar," which approximates to our "Assistant Conservator," is not given, nor are our terms "Forest Division" and "Divisional Officer." Various American terms are to be found in the vocabulary, most of which will probably be strange to European foresters; take, for example, the words to chit (to sprout or germinate), circulation period (rotation), culled lands (lands cleared of forest), fail-place (blank), offal timber (refuse timber), etc. We venture to congratulate Professor Gerschel on the success with which he has dealt with a somewhat difficult subject, and to express, on behalf of Indian foresters, our gratitude for the production of what will be a most useful book of reference.

INSECT ATTACKS IN THE FORESTS OF THE VOSGES * MOUNTAINS.

AN INVASION OF SCOLYTIDÆ.

On February 1st, 1902, the forests in the Vosges Mountains in France were visited by a severe hurricane, which blew down in a few hours 1,233,283 cubic metres of coniferous trees in the Crown and Communal forests. The losses sustained are estimated at 9 millions (francs). Whilst the Forest Officers were grappling with the ruin and disorganisation following upon this catastrophe a fresh disaster faced them—an invasion of scolytidæ or bark-boring beetles.

Three conditions aided, and not improbably led to, the attack of the beetles. Under the influence of the hurricane the larger number of the trees had been overthrown at the roots, portions of these latter still remaining in the soil; the ends of the branches of the trees still standing, first thoroughly drenched and then frozen, became very brittle, broke off and covered the soil beneath with

*This paper is based upon an article entitled "Une Invasion de Bostriches dans les Vosges," by M. de Gail in the *Revue des Eaux et Forêts* for April 1st, 1905, page 193.

an uninterrupted layer of branch wood ; and thirdly, the trees in the immediate neighbourhood of those overthrown were considerably damaged. In speaking of an "invasion" of bark-boring beetles the word is used in rather a figurative sense, for there is no invasion in the true meaning of the term. Forests usually hold insects of many different genera and species, whose latent power of increasing in enormous numbers is ordinarily held in check by many and numerous natural causes. When these natural causes are for the moment, it may be for the space of a few weeks only or for several years, removed, a particular species may increase in large numbers owing to an increased proportion of individuals of successive generations reaching maturity. The conditions which are denoted by the term "invasion" of insects then prevail. In the case of some insects, more especially in the case of the blights (aphidæ) and scale insects (coccidæ) and, to a lesser extent, the bark boring beetles, the power of rapid reproduction and multiplication under favourable circumstances is very great. The European bark-borer *Tomicus typographus* lays 80 eggs, and taking half to be males and half females, the second generation will contain 40×80 or 3,200 individuals, the third 128,000 and the fourth 5,120,000 insects. In cold wet years there is only one generation in the year, whilst in dry and warm ones there are two; in the latter case two years suffice to produce the above mentioned large total of beetles from one insect. Practically a mortality of 30 per cent to 50 per cent would be allowed for. We shall see what great damage and dislocation of work half this increase of the *Tomicus* pest is able to effect in European forests, and the sad experience of our confrères in the Vosges has a serious significance for foresters in India. Wherever there is proper forest conservancy and the nearer that conservancy approaches to efficiency and intensity of management the greater will be the danger from insect invasion. India will prove no exception to the rule, and that these attacks will be on a large scale is readily understandable when it is remembered that it is almost the rule instead of the exception for an insect to pass through at least two generations in the year, and the number is often double or more. For instance, *Scolytus major*, a bark-borer

which attacks the deodar in the North-West Himalayas, probably invariably has two generations in the year, eggs being deposited at the end of April and again in July, and it may have a third or part of a third. The number of eggs laid is between 60—70, so that the number reached at the end of the first year would be, if all survived, 54,000, and at the end of the second 738 millions. Again, the bamboo boring beetle, *Dinoderus minutus*, may pass through five or more generations in the year ; the female lays about 20 eggs, and thus at the end of the first year we have 2,00,000 and at the end of the second the gigantic number of 10,000 millions of beetles as the result of the progeny of one insect. These are only two instances out of many studied during the last few years, but the research work accomplished has led the writer to attach greater and greater importance to the study of the life-histories of Indian forest insects. As will be shown, the measures which have been taken and are being taken at the time of writing in the Vosges are only possible owing to the fact that the life-history of the aggressor is known.

We have detailed above the three conditions prevailing in the forests after the hurricane, these conditions being eminently favourable to an increase of Scolytidae. A fourth was to be added, for, as we shall see later, the winter and spring were warm and dry—conditions which invariably lead to increase in insect life.

It will be well known to many of our readers that the true bark-borers will only attack trees in which the bast layer is fresh and sappy, for it is in this that the grubs hatching from the eggs chiefly feed. Once the bast layer loses its moisture any bark-borer larvae or pupæ it may contain will die off. Looking at the conditions which prevailed in the Vosges forests after the storm of February 1903 we see that they contained many half-uprooted prone trees in which the upward flow of sap was much weakened ; also a number of trees which, although still standing, had been badly bruised and knocked about by their falling neighbours ; in these also the sap-flow was greatly impaired. The bark-boring scolytid beetles prefer, next to freshly felled trees with the bark full of sap, which is no longer ascending in the full tide rush of active, healthy circulation, trees in the condition described above,

where the vitality of the tree has been checked. The invasion of 1903-04 in the Vosges, therefore, the first beginnings of which the writer was fortunate enough to himself witness, was a foregone conclusion, and it was very greatly helped by the dryness and almost tropical heat experienced in 1904 even as early as the beginning of June.

The beetles responsible for the damage were *Tomicus typographus*, which confines its attacks to the spruce, and *T. curvidens* in far less numbers in the silver fir. Both these insects were taken by the writer at the commencement of June in felled trees in the Gérardmer forests in the Vosges.

It is scarcely necessary, nor would it be relevant to the purpose of this article, to detail the life-histories of these beetles here. *T. typographus* is the one whose attacks are the chief object of attention, and it has already been stated that under favourable conditions it may pass through two generations in the year. This is what appears to have happened in 1903. It was at the end of the second week in October that the seriousness of the attack was first noticed, and the area infested was in the Canton of Mérelle in the Communal forest of Gérardmer. The infested trees were at once cut down, barked, and the bark burnt. The situation it is said was not then considered serious. With the large amount of fallen trees and standing trees of reduced vitality in the forests we are of opinion that had a rigorous inspection been instituted in October it might have been possible to have taken such steps as to have reduced the scale of the attack of 1904. It was only in the spring of 1904 when the Forest Officer of Gérardmer reported having noticed large flights of Scolytidae in the vicinity of the lake that it became recognised that an invasion of these insects was imminent. The writer visited these particular forests in company with Mons. Henri and the senior students of the Nancy Forest School at the beginning of June, and was able to satisfy himself as to the apparent general abundance of the beetles in these areas. The insects seen in the spring were the mature beetles which had passed the winter, as is their custom, under moss, in the interstices of the bark, &c., of the trees. The mild

winter had favoured the beetle, which, however, is capable of resisting to an extraordinary extent great cold. This has been proved quite recently. A specimen of *T. typographus* was taken in a mass of ice fixed to a piece of bark. The beetle was stuck to the bark and appeared to be dead. On heating the ice it melted and the scolytid at once showed itself to be full of life and vitality. This observation is of great importance since it proves that all the individuals of the autumn generation which are able to reach the mature condition have every chance of passing through the winter, and consequently of egg-laying in the succeeding spring.

By May 1904 it was realised that a serious invasion of the beetles was imminent, and instructions were issued as to the measures to be taken throughout the whole of the mountainous region of the Vosges. Since the life-history of the beetle was well known, and this is the important point to be borne in mind in India, there was no difficulty as to the lines upon which the attack was to be met and combated. The instructions were—

- (1) Search for all infested trees.
- (2) As soon as found fell them, cut off the branches and bark the stems.
- (3) Burn the whole of the branch wood and throw into the fire all the bark of the trunks. This bark and the branches being full of the larval, pupal and immature beetle stages of the insect, the whole of these would be killed off.

Unfortunately it is not easy to mark down the attacks of this beetle. It bores into the trunk, but commences high up, and those following tunnel in either above or below the first arrivals, almost invariably leaving, however, the lower 6—7 feet and the branches untouched. During these attacks there is practically no external sign that the tree is suffering, since the beetles hide their small entrance holes by boring in at interstices and beneath projecting flakes of bark. The fine particles of sawdust ejected from the holes, fallen from a height, are dispersed by the wind before reaching the ground unless caught on their way down in some spider's web stretching across the space between two neighbouring trees or over the undergrowth below. In the case of crooked boles the sawdust

may be seen caught on the bark beneath the hole, but in most cases remarkably good eyesight is required to see this.

The tree continues to live as long as only the vertical galleries, *i.e.*, the egg galleries made by the beetles, are present. As soon however as the larvæ hatch out and commence boring the horizontal galleries on both sides away from the egg galleries the tree begins to show signs of losing its vitality. In serious attacks, such as the one we are considering in the Vosges, the vertical egg galleries are so numerous in the tree that the horizontal ones bored by the larvæ soon begin to interlace and cross each other,* with the obvious result that the whole of the cambium layer of the part of the bole infected disappears, the flow of the sap ceases and the tree turns yellow and dies in a few days. That tree has been lost, and with it will go every one of its companions infested in a similar manner. This is the point, an extremely important point, to be remembered in the case of coniferous forests. Unless and until the life-histories of the insect pests of such forests are well understood, not by the Officers in charge of the divisions only, but by the subordinate Officers in charge of the units, the range and the beat; and, given that such knowledge is present, until it is possible to practically apply it by maintaining the necessary close supervision over the areas, our Indian coniferous forests will year by year, as our management of them becomes more intense, and diseased and dying trees get rarer and rarer, become more subject to such an attack as the Vosges Officers are now combating. It is scarcely necessary to point out how disastrous such an invasion would prove in some of the Himalayan forests and what would be the result if the trees on catchment areas, strictly protected against all fellings in order to maintain the water supply of the great towns and stations, were to be suddenly wiped out by an invasion of one or other of our at present so

* Mr. J H. Lace, Conservator, Pegu Circle, took a beautifully clear photograph of a piece of *Pinus excelsa* bark showing the vertical egg and interlacing horizontal larval galleries of a Himalayan Tomicus which had killed a tree in this manner. The photograph is reproduced in Dept. Notes, No. 2 Plate XIV.

little-known Indian bark-borers. The time has gone by when such an eventuality could be put off as improbable, if not impossible, because forsooth it had never occurred before. We are only considering coniferous forests here, but much the same could be written on the subject of our broad-leaved forests.

Returning to our attack; as soon as the trees begin to turn yellow they must be immediately cut out and barked in order to kill the larvae and pupae and all unbarked branch wood be burnt. If this is not done at once the pupae will mature into beetles, and these will bore out of the tree and at once commence to attack fresh ones. When a tree is full of larvae, mining out their galleries in the bark and sapwood, if the ear is placed against the bark the grinding sound of the millions of small mandibles can be distinctly heard. When the bark is peeled off, and it comes off easiest in the summer and autumn, there will be found to be a cushion of brown sawdust and larval excreta between it and the sapwood, and this will also tightly fill the larval galleries. On the bark at the end of these galleries the small white larvae or immature pupae will be easily perceptible, but no beetles. If however the sheet of bark is placed inside upwards on the branch fire as soon as the heat is felt all the immature and fully developed beetles which will be hidden deeper in holes at the end of the larval galleries will soon come to the top. It is to catch these advanced mature beetles that the bark should be, wherever possible, burnt. Simple exposure of the bark inside upwards to the sun and air will kill off all immature beetles, pupae and larvae without the aid of fire being necessary, and this is especially true in India, where a hot sun shrivels them up within the hour, if fully exposed to it. Only absolutely fully mature beetles would survive the ordeal of exposure in India. These however it is most necessary to catch, and I would therefore recommend that the bark be always burnt.

At Gérardmer to ensure securing all the occupants of the trees a large sail cloth was slipped beneath the felled tree before the barking operation was commenced. This, owing to much of the forest being situated on rocky slopes, was quite easily done, and

in the small areas that had to be dealt with was not only feasible and eminently practical but gave excellent results; all the débris with larvæ and beetles which fell on to the cloth was swept into the fire before the cloth was lifted to the next tree.

In a few days over 150 standing spruce aged 100 years old and situated close together in the 4th series of the State Forest of Val de Seones died. In spite of the precautions which were at once taken the invasion spread through this forest, a large number of trees having to be felled. The infection made its appearance about the same period in the Gérardmer Forest in the Mérelle Canton, and heavy fellings had to be made in this. Other forests were successively attacked, but not in the same degree of intensity. In July 1904 it was found that the insects in the trees were all in the same stage of metamorphosis, but this was not the case in October, when all stages of egg, larva, pupæ and imago were present, and this was found to be the condition of all the trees felled throughout the winter of 1904-05.

Tomicus curvidens resembles *T. typographus*, but is much smaller; it attacks the silver fir. This insect first made its appearance near Saint-Dié in July. A month later it was found in the State Forest of Rambervillers, and about winter time near Seones. The damage done by it was not serious though some trees were killed.

The following table shows the result of the attack of 1903-04:—

		TREES FELLED.		
		Number.	Volume.	Value.
			Cubic metres.	Frances.
State Forests	...	6,115	7,031	143,130
Communal Forests	...	8,488	11,282	207,654
Total	...	14,603	18,313	350,784

The most serious attacks of the beetle and therefore the heaviest fellings were in areas of pure spruce from 80 to 90 years

old in Gérardmer and Mérelle which were fully stocked and vigorous before the double disaster of the storm and invasion fell upon them. Elsewhere the areas felled are smaller and more dispersed. Owing to difficulties connected with the labour supply and, in the case of the Communal Forests, want of funds a certain proportion of the trees (448 m.c. State and 7516 m.c. Communal) were sold standing with the proviso that all the branches and bark were to be burnt on the spot as soon as the tree had been felled. This of course brought down the price obtained from the forced fellings. The work had to be completed by the 10th April 1905, and this condition was observed. Taking 150,000 beetles per tree it is computed that about 2,200 millions of beetles have been killed, but it is apparent that the insect has not yet been stamped out, and attacks are feared during the present year, attacks which it will be more difficult to combat owing to their being probably more widely dispersed. Trees still infested will have to be carefully searched for and cut out or they will serve as centres for further infection.

The spruce occupies about 4,753 hectares in the Vosges. The trees on about 50 hectares were killed in 1894. Throughout the winter preparations have been made in order to endeavour to protect the rest of the area. The officers also count, and with some probability, on the assistance during the present year of predaceous enemies of the bark-borers such as *Clerus formicarius*, &c., which have probably increased to a considerable extent though large numbers must have been exterminated with their hosts in the fires of last year. An account of this year's action should prove of considerable interest, and we trust to hear that our confrères will have succeeded in protecting from further injury their beautifully tended forests on the slopes of the lovely Vosges Mountains.

E. P. STEBBING.

FOREST ADMINISTRATION IN BALUCHISTAN, 1903-04.

From a forest point of view Baluchistan may be said to be a country entirely apart from either India or Burma, for in neither is there any approach to the conditions appertaining in Baluchistan.

The area of reserves is now 208 square miles, five square miles having been added during the year. This area represents but a small proportion of the forest areas in the Agency, and reservations on a considerable scale are now under consideration. Some of these areas are already under the temporary charge of the Department. By far the finest forests of the country are in the Zhob Agency, and the question of their reservation, which has been pending for several years, is now, it is hoped, nearing realisation. These forests are at present under the Political Officer, who has a small staff under him.

There are two main questions which have to be carefully considered in connection with Baluchistan reservation, the one the ever-green grazing question, the other that the people themselves claim and own, or are supposed or held to own, the produce of the forests.

The inhabitants are primarily, if not almost entirely, graziers. Their sheep and goats, and not their crops, are their source of wealth, and long centuries of grazing at will over the hills has rendered the question of forest reservation a delicate matter. But whilst they are graziers, many of the tribesmen are fully aware of the value of the forests, and not only have certain rules for their protection in force amongst themselves but are quite ready to avail themselves of any outside Government help to forward this end. This has made itself apparent in the case of the Zhob forests, and it is probable that the existence of this feeling amongst them will greatly assist towards a *modus vivendi* being arrived at for the exclusion altogether of grazing from the more valuable forests.

On the subject of the ownership of the tribesmen in the produce in many of the forest areas there appears to be little doubt amongst certain of the Political Officers. Whilst these rights will require careful enquiring into, they will, on the other hand, facilitate the reservation question, since it is becoming apparent that the people will favour and accept any steps which can be shown to be in the interest of the amelioration of the forest crop. That the country will indirectly but largely benefit there can be little doubt, since the closing of the better forests, mostly situated on the hills, to grazing

will result in natural regeneration and a consequent larger and better flow of water.

We read in the Baluchistan Resolution on the Report that "it is stated that the areas it is proposed to demarcate" (in Zhob) "are too high and inaccessible for grazing, and they must therefore be so inaccessible that timber and fuel cannot be removed from them. Consequently it would seem that ample preventive measures have been taken by nature to reserve these forests to posterity. Should it be proposed to extend reservation to more accessible areas, it is quite possible that the tribesmen may be found to raise objections."

As regards grazing, sheep and goats undoubtedly graze within the tree limits in the Shinghar Chilgoza forests; and it will not be surprising to learn that they are also to be found in the Sherghali forest and in those on the Takht-i-Suleiman, which have not been visited. As regards the timber question, it does not come into consideration in the case of the Chilgoza forests, since the tree is of value owing to the edible nature of its seed and to the fact that this latter is annually collected for sale by the tribesmen. These Chilgoza forests are consequently most valuable ones, and the area must be indeed an inaccessible one that cannot be reached by a mountaineer when his object is merely to collect for sale such a valuable product as the seed of the cones of this tree.

The forests of Baluchistan would appear to be of such political importance in the part they may take in the peaceful settlement of the country, and their unquestioned utility as a reserve of fuel for troops in case of need is of such importance, that the question of a surplus or deficit in the annual income obtained from them needs but a passing glance. For years to come it would appear that the former should be non-existent, since the forests will well repay in other ways money expended upon them.

Baluchistan might well be called the fruit garden of India, and the question of the cultivation of fruit trees and even roses appears in the pages of the Annual Report. The Forest Officer has under him some gardens, in which the raising of fruit trees—

mulberry, apple, pear, plum, apricot, almonds, cherry, &c.—forms the chief part of the work going on in them. Young plants are sent out into the districts to be made over free to the people, and it is in this direction that it appears possible to realise a revenue compared to which anything that can be obtained from the forests will be thrown into the shade. In Quetta itself there is a large demand for roses for the preparation of atar of roses.

An extremely interesting experiment is being undertaken in an olive forest at Torkhan in the Loralai District. A small area of four acres of the trees, which are stunted and many-headed from centuries of grazing, has been closed to grazing and the trees and bushes have been coppiced. On the coppice shoots it is proposed to graft the valuable olive of Europe, and in the climate of Baluchistan there appears to exist every hope that this experiment will prove a success; it is not improbable also that they will yield a valuable return.

Bhai Sadhu Singh, the Extra Assistant Conservator in charge of the Baluchistan forests, appears to have a most interesting and valuable charge under his care.

SHIKAR, TRAVEL AND NATURAL HISTORY NOTES.

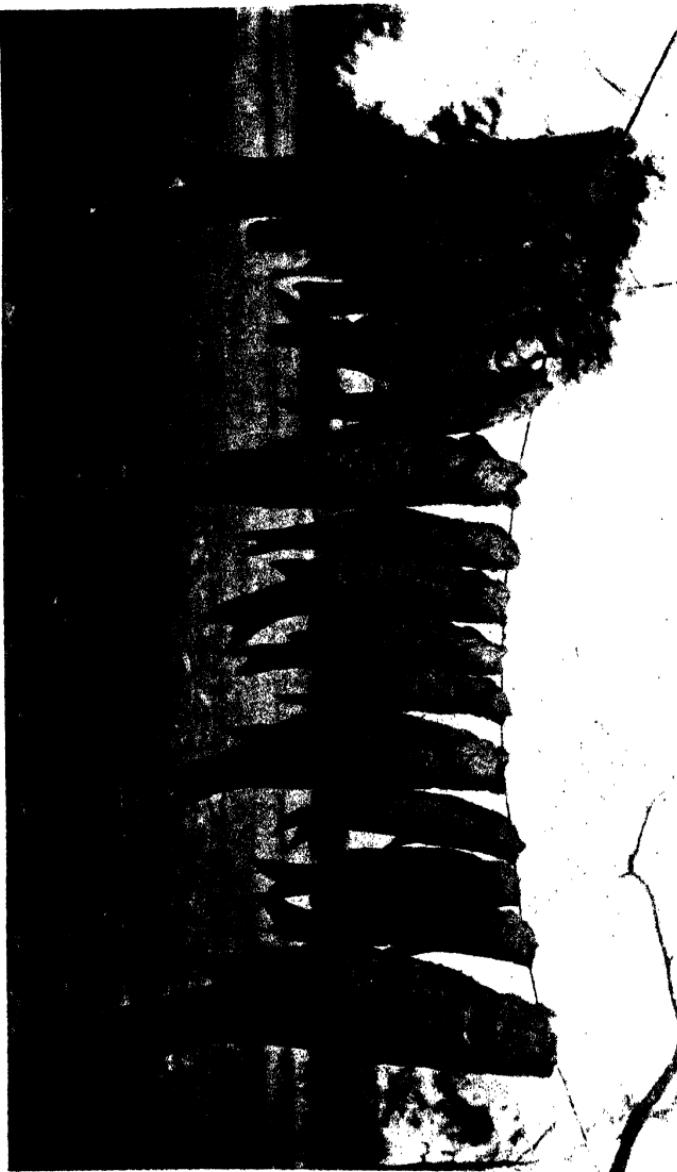
A MORNING'S MAHSEER-FISHING IN THE GANGES.

The above photograph depicts a catch of 14 out of 15 mahseer taken in the Ganges below the Song Junction on the 1st April last.

These fish were killed on a 12-ft. ringal double gut trace and number 5 spoon, between 9-30 A. M. and 1-30 P. M. Sport was put an end to at the latter hour by the rod breaking in the middle of a cast, owing, I am told, to the spoon being too heavy for it.

The total weight of the catch was $72\frac{3}{4}$ lbs. and included one fish of $14\frac{3}{4}$ lbs., another of $13\frac{1}{2}$ lbs., and a third of $8\frac{1}{2}$ lbs.

E. R. STEVENS.



E. K. Stevens, Photo.

A fine catch of Mahseer from the Ganges.

IN THE UGANDA FORESTS.

I think the accompanying extract from the letter of a young Assistant Forest Officer in Uganda which I received a few days ago may interest your readers. He studied forestry under Colonel Bailey at Edinburgh, and afterwards went round the German Forests with Dr. Schlich, and so obtained a forest berth in Uganda.

G. F. PEARSON.

DATED CAMP VIA NAIWASHA (UGANDA), 30TH MARCH 1905.

* * * *

All the country I have seen so far has been delightful and well adapted for men of the right sort to settle on. There has been a great influx of settlers from South Africa, and a few from England. So far this Protectorate has been most unfortunate in its settlers; the greater part of them are loafers from the Transvaal, and there is also a contingent of so-called "aristocrats," who do no good at all, and are a trouble to the Government, and only grumble at everything without any effort to help themselves. An attempt to form a Volunteer Corps resulted in a dead failure, one of the objections being that they could not have ammunition for shooting purposes at half cost instead of pay! I dont know if the Forest Department will stand or fall when Mr. Elliot resigns in April. The forests are then to be handed over to the Agricultural Department, the head of which is no Forester. The Commissioner says that he wants to run the forests on the cheap, his argument being that because we dont bring in a large revenue, we are not worth our pay; and he compares us with the department that collects the hut tax! However, things may improve when the Colonial Office takes us in hand. There are some very good forests, at present little known except to the natives, whose aim and ambition seems to have been to destroy them, though they are already beginning to learn not to do so. The two most useful species for all round work are Juiiper and Podocarpus; of hardwoods there are many, but at present their timber is of no economical importance. Trees extend up the mountain sides to about 8,000 feet, when they are

succeeded by bamboos which flourish up to an altitude of 9,000 feet. Above are found many varieties of heath and the Giant Groundsel. I am looking forward to the time when I shall be able to take over the forests on the slopes of Henia. At present it is out of the question, as I have some 500 square miles to attend to and put under some sort of protection. At present I have not seen a lion nor an elephant, but I ought to have a chance, as there are a good few wandering about.

EXTRACTS FROM OFFICIAL PAPERS.

A LONDON REPORT ON BURMA WOODS.

I beg to send you, for what they may be worth, the enclosed copies of correspondence *re* a sample of consignments of certain woods of South Tenasserim.

The writer of the "Report on Burma Woods" has an extensive vocabulary of depreciatory terms but, to my mind, shows little knowledge of the timbers in question or the special uses to which they might be put as ornamental woods. This one is regarded as a substitute for teak, that as a substitute for ebony. Had a reference been made to Gamble's *Manual of Indian Timbers*, Laslett's *Timber Trees*, or some other good book on the subject, the writer might at least have concealed his ignorance. I submit that it is a waste of money to send samples of timber to London only to be informed what is thought of the colour, texture, shakes, cracks and other defects; to learn that it is undesirable that a wood should be "wild-grown," that those who report on the prospects of a trade in the woods sent to them have no conception of their use except as a substitute for a timber already on the market, and evince no interest in discovering what they are fit for. It is a pity that some retired Forest Officer with a good knowledge of Indian timbers cannot introduce some of them to the small industries which use ornamental woods. It is, of course, desirable that the samples sent should be of good quality and attractive in appearance: but except for an international exhibition, large squares cannot be wrapped in paper or packed in cotton-wool, and

I doubt whether, for commercial purposes, it is wise to send too choice a sample either as regards size or quality. These samples should be of a good average quality which can be supplied in quantity. It is desirable that they should be consigned to some one who will take the pains to work up the woods, discover the special purposes for which they are most fitted, exhibit them attractively to consumers, and push their sale. On the other hand, the consignor should be able to give information as to supplies available and probable price. It is perhaps natural that a firm interested, say, in padouk, teak or mahogany should not take any trouble to introduce a substitute for the article in which they trade, though it is possible that they might make large profits on the substitute. I think Government would derive more profit from appointing capable agents in England than from equal expenditure upon exhibitions.

RANGOON :

F. B. MANSON.

April 1905.

Endorsement No. 1058/2T., dated 7th February 1905, by the Divisional Forest Officer, South Tenasserim.

Copy of the following forwarded to the Conservator of Forests, Tenasserim Circle, for information.

Letter No. 360, dated 6th January 1905, from Messrs. Gillanders Arbuthnot & Co., Calcutta, to the Divisional Forest Officer, South Tenasserim.

We have the honour to enclose copy of a report of a small parcel of miscellaneous timbers received from you and sent to London for examination. These are the timbers referred to in your No. 77 of 29th April 1904.

We regret that they do not appear to suit the requirements of that market or to hold out any promise of developing a business in them.

London, 8th December 1904.

REPORT ON BURMA WOODS.

The two Che logs are of reddish colour, somewhat similar to the inferior varieties of Padouk ; they are straight and well made but somewhat end-shaken.

The two logs of Gangaw are of coarse texture and somewhat similar in colour to the Che logs ; they are very sappy, also rather waney and end-shaken.

The Sinkosi log is of brownish colour, somewhat similar in grain to oak ; the log is, however, wormy and very sappy. Not an attractive sample.

The Taungbog log is of soft texture and bluish-grey colour ; it is straight and fairly well made, but badly ring-shaken.

The Kinthat is of mild texture and brownish colour ; it is, however, an inferior log, being waney, knotty and very grubby.

The Thitkado log is in colour somewhat similar to cedar, but the grain is coarse ; the log is fairly sound but wild-grown and waney.

The Thitka log is of usual reddish colour and close texture ; it is well made, straight, and fairly sound.

The two Kanzaw logs are of reddish colour, somewhat similar to mahogany but of coarse texture ; they are straight and well made but seriously side-shaken, being very shelly.

The Karawe log is of mild texture and reddish-brown colour ; it is fairly well made but rotten at one end.

The Anan log is of light-brown colour, sound and well made.

As regards the prospects of the above logs, there is little to recommend any of them. The Che and Gangaw logs might possibly serve as substitutes for Padouk if this were scarce, but not in competition with the African variety, which is heavy in stock at the present time, and is sold with difficulty at about £3 per ton. The Thitka, Thitkado and Kanzaw are likely to be difficult of sale, African mahogany of similar size and better quality being easily obtainable at 2½d. per foot. The Sinkosi appears of fair character, but is not of equal merit to the sample sent some time back. The Taungbok, Kinthat, Karawe and Anan, however, have no attractive features, and we do not see any opening for them, the first being useless as a substitute for ebony, and the second equally so for teak.

[We understand from the Conservator that he was unable to himself personally inspect the logs before they were despatched to London. It is a commonly known

fact that the London dealers do attach the very highest importance to the external appearance of a log, and an inferior log with trimmed ends would in most cases probably sell better than a finer one whose ends were in the rough condition they had left the forest in. No one is more fully aware of this than the Burma Timber Companies, who pay the greatest attention to such niceties. That there are good men in London cannot be doubted by those who have read the series of articles on "New Woods" reproduced at pp. 108 and 177 of this volume. It is with such men, not only in London, but at all the important forest produce-importing trade centres throughout the world, that we, through the medium of an Economic Research Bureau, should be able to get into touch with.—HON. ED.]

DISCONTINUANCE OF THE CULTIVATION OF THE EDIBLE DATE IN MADRAS. *

The following extract from the Report of the Superintendent of the Government Botanical Gardens at Saharanpur appeared in the *Pioneer*:—

"There are two matters which call for notice in the report on the acclimatisation and other experimental work carried on at the Government Botanical Gardens at Saharanpur. Considerable experiments have been made with the cultivation of the Arabian date-palm, and the Superintendent now states that while date-palms with ordinary care thrive well in the soil of Saharanpur, and may be cultivated for landscape or ornamental effects, they are of little or no use as fruit or food-producing trees. Even in abnormally dry seasons one or two small showers of rain are sufficient to destroy the bulk of the fruit, and it is only in the event of an almost complete failure of the monsoon—fortunately not probable in any part of the Province—that the fruit might be expected to ripen to perfection. The date-palm can only be expected to be a success as a food-producing tree where there is hardly any or no summer rainfall, and yet sufficient water to supply the roots with a fair amount of moisture throughout the summer."

Mr. A. W. Lushington, Conservator of Forests, Northern Circle, Madras, in drawing the attention of his Government to this extract enquired whether, since edible dates were bound to fail as

* From papers placed at the disposal of the Hon. Editor by the Government of Fort St. George.

food-producing trees in a country when there was the smallest amount of rain during the fruiting season, it was advisable to expend any further sums on the experiment of the cultivation of the tree. The Commissioner of Revenue Settlements and Land Records referred the matter for report to the Deputy Director of Agriculture and the Government Botanist. The former concurred with the opinion of the Conservator.

Mr. Barber in a memorandum considered the subject at some length, pointing out that the date-palm was an inhabitant of the so-called "rainless tracts" of the earth, requiring a dry heat with a daily maximum of 100° F. from May to October when its fruit is ripening. A rainfall of 5—10 inches in the year is sufficient, but should not occur during the fruiting period. A daily variation of temperature, such as occurs in desert regions (and this is frequently very wide) would not be injurious, but although frost is not harmful more than 10° below freezing point should be avoided. With this dryness of the atmosphere the tree requires an abundant supply of readily available sub-soil water or the means of ready irrigation with perfect drainage. A valuable property of the tree is its remarkable indifference to soils heavily charged with alkali, and it is said that it can even thrive when irrigated with water so full of brine as to kill all other trees and crops.

Having fully considered the reports before him the Commissioner of Revenue Settlements and Land Records was of opinion that it was inadvisable to continue the experiments in the cultivation of the date as a food-producing tree in the Presidency.

MISCELLANEA.

PROPOSED FOREST SERVICE IN THE HAWAIIAN ISLANDS.*

The people of Hawaii almost unanimously favour the immediate institution of a system which will protect and restore the mountain forests. Guided by this emphatic sentiment, the last legislature passed a bill creating a forest service, and outlining

*Extract from "The Forests of the Hawaiian Islands" by W. L. Hall (United States Department of Agriculture; Bureau of Forestry, Bull. No. 48. Washington, 1904.)

to some extent a forest policy. Under the law the responsibility of the service rests on a non-salaried Board of Agriculture and Forestry, whose duty it is to gather and publish information concerning the forests of the islands, to provide for the introduction, propagation and planting of useful forest trees, to establish forest reserves so far as necessary for the protection, extension, and utilization of the forests and the safeguarding of the sources of water supply, and to protect the forest reserves from damage by cattle and other agencies.

The Board is authorized to appoint a Superintendent of Forestry who is to be a trained forester, and under the direction of the Board is to have immediate charge of all forest work. The Superintendent of Forestry is to have such paid assistants and rangers as the Board may find necessary for handling matters connected with the forests and forest reserves.

The Board is also to appoint in each district one or more consulting foresters, who are to serve without pay and advise the Board concerning forest matters in their districts.

A biennial appropriation of approximately \$28,000 per year has been made to carry the law into effect.

The Board of Agriculture and Forestry has invited the Bureau of Forestry of the United States Department of Agriculture to assume an advisory position in connection with its future policy. On the nomination of the Bureau a trained forester has been appointed as Superintendent of Forestry, and has already entered upon his work.

Appointments of Assistant Foresters and Rangers are being made as rapidly as the needs of the service require.

FUTURE POLICY.

No attempt can be made here to do more than point out the main principles which must govern the future policy of the islands in the maintenance of a forestry system. These are as follows :—

FOREST RESERVES.

Nothing less will be effective toward the preservation of the Hawaiian forests than a carefully worked out system of forest

reserves, which will include practically all of the mountain forests previously mentioned, as well as some potential forest land which has been denuded. This reserve system should be established as soon as possible, beginning probably in Kula, Hamakua and Kohala, since in those districts there is greatest immediate need of protection. The territorial Government owns most of the land which should go into the reserves, but the Government land is largely held by individuals or companies under leases, some of which will not expire for a number of years. The lessees of many important tracts are willing to relinquish the forest land to the Government in exchange for reasonable extension of leases, or for new leases on other lands. Almost all of the reserves will also need to include some land held in fee simple by individuals or companies. Here, again, the only solution of the question is by the Government exchanging with the private owners.

It is evident that each reserve will have to be made, a part at a time, as satisfactory exchanges can be made, both in leased and owned lands. The possibility of such exchanges is entirely dependent upon the co-operation of the Government with the individuals interested. Good results will be accomplished only when both parties fully understand the importance of the proposed reserve, and enter into negotiation solely to secure fair and equitable exchanges.

As soon as a reserve is formed, all cattle should be driven out and the portions which are accessible to cattle should be fenced. Those wild cattle which cannot be driven out should be shot. An effective ranger service should be put into effect to keep stock and fire out of the reserved forest. As soon as practicable, on each reserve men should be employed to hunt down and exterminate the wild goats.

PLANTING.

With the reserves well protected, the forest will replace itself on many of the damaged areas, as reproduction under some conditions takes place rapidly. Where the forest will not replace itself, planting will be necessary, and can be done with direct profit to the islands if commercially valuable species are made use of and

are planted in the right situation. Conditions prevailing at 5,000 to 6,000 feet in Kula, Hamakua and Kau strongly indicate that Pacific coast species, such as red wood and red fir, would do exceedingly well. Eucalyptus, Monterey, Cypress, Casuarina, Grevillea and several other trees have already shown their adaptability for these situations. It is specially important to find trees suited to these and higher elevations, because the native forest is often deficient at such elevations, although the land is good forest land and can never be used for other purposes. In some situations it may be desirable to plant species bearing edible fruit, such as the alligator pear and breadfruit.

For the present, forest planting should wait on the formation of the reserves. Forest already planted on Mount Tantalus and in Nuuna Valley should be cared for, and the nursery should be maintained, but no extension of planting or of the nursery should be attempted until the reserve system is fairly under way.

LUMBERING.

As soon as practicable, an examination should be made of the Koa forest on the east slopes of Mauna Kea and Mauna Loa, to determine whether or not it is feasible to build a road to it and locate a saw mill in it for the purpose of lumbering the mature trees. Some of the Koa is without doubt very fine, and would form a source of revenue to the territory to which it belongs, if it could be got out without great expense. The law provides that any moneys which shall accrue from such products shall be held available as a special fund for the preservation, extension and utilization of forest and forest reserves, in the same manner as moneys appropriated by the legislature. This makes it desirable as soon as possible to make the forest revenue-producing, so far as this is compatible with its preservation for other useful purposes. It is believed that the situation and composition of the Koa forest is such that the removal of the mature trees could be accomplished without damage either to reproduction or to water supply.

CLEARING.

The law makes it mandatory upon the Board of Agriculture and Forestry to pass orders upon the disposition of any public land,

not including roads and city lots. All leases and sales of forest land, carrying the right to cut timber or clear the land, must therefore be approved by the Board. Since the clearing of land for the extension of canefields and for homesteads is at the present time making irreparable inroads upon the virgin forest in important localities, it is of special consequence for the Board to act with the greatest caution on all permits to clear land. The only safe attitude for the Board to take under present conditions is to assume that all the Government forests should remain intact, and it should recede from this position only in those individual cases where the contrary is plainly proved.

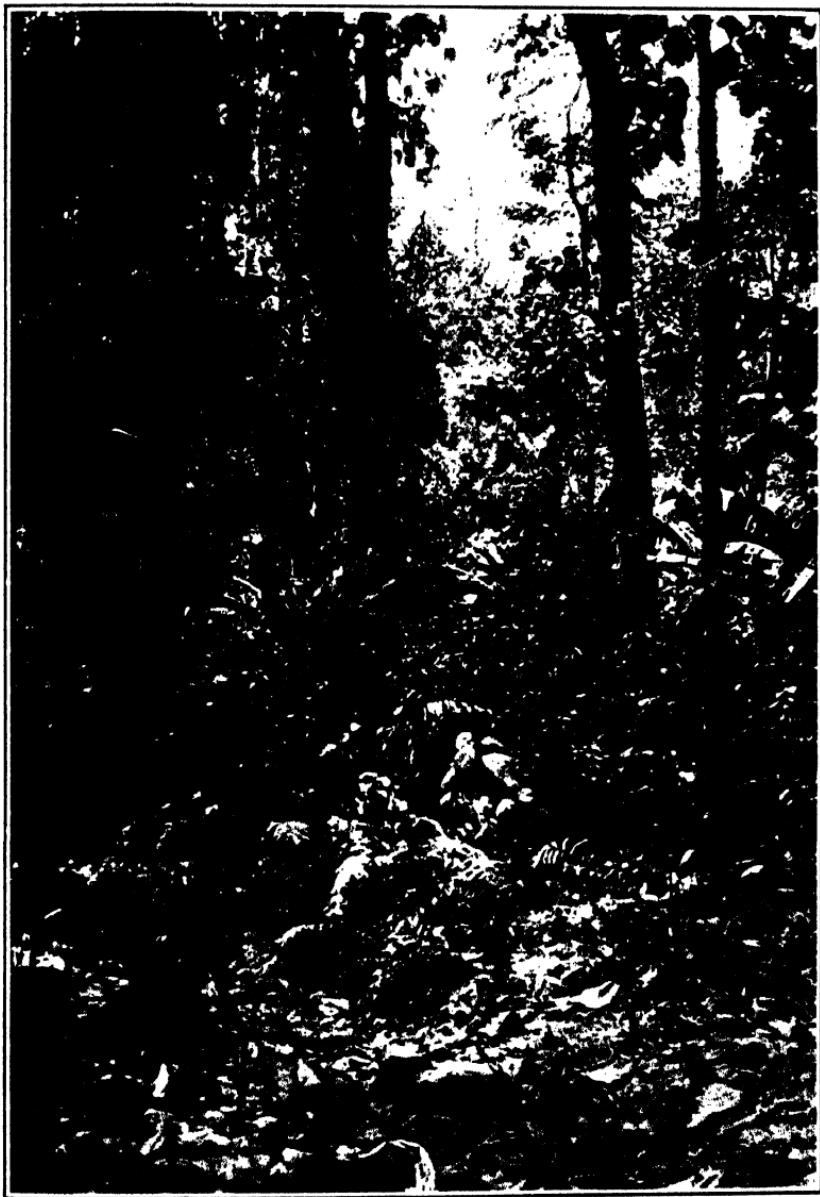
EXAMINATION OF INSECT PESTS.

The effective work which has been done by the entomological service of the islands toward the extermination of certain kinds of injurious insects suggests the possibility of ridding the forests of some of the insects which are devastating them, and furnishes ground for the recommendation that the Board, in connection with its entomologists, take the matter into consideration.

ASSISTANCE TO LANDOWNERS.

Throughout the islands there is great interest on the part of both individual and corporate landowners in the development and preservation of forests. And yet the individual is often at a loss to know what trees to plant for his situation--where to get them, how to plant successfully and how to care for the planted or native forest. This is information which only the trained forester can give. For lack of it some landowners have made no efforts in forest work; others have worked with meagre results.

It should be a part of the forest policy to give such assistance to landowners as the need requires. Studies should be made on the ground to determine what trees to plant and what methods to adopt, both in the establishments and in the care of woodlands. In many cases it will be beneficial, if not necessary, to assist in procuring seeds and plants, especially those which have to be procured outside of the islands. In so far as the Government nursery is made use of for the production of trees for planting on private



TEAK IN EVERGREEN FOREST IN LOW HILLS, MOHNYIN, U. BURMA.

lands, the trees should be of valuable economic kinds, and where distributions are made from the nursery the planting should be done under the supervision of the Superintendent of Forestry.

CO-OPERATION WITH THE BUREAU OF FORESTRY.

The close relation existing between the forest service of the islands and the Federal Bureau of Forestry can be maintained with direct benefit to each. It will strengthen the insular service to have the advice and support of the Bureau in dealing with the problems which it will have to meet. On the other hand, such co-operation will enable the Bureau to keep in as close touch with the forest administration of these important islands as it does with forest affairs in the different States.

TEAK IN EVERGREEN FOREST.

The accompanying illustration shows a patch of teak with an undergrowth composed of evergreen trees and shrubs, plantains and palms in the Mohnyin Reserve, Katha Division. This type of forest is not uncommon in certain parts of Upper Burma. Teak reproduction in such forests is nearly always absent, and it seems probable that the evergreen species have spread into forest which was originally deciduous. Evergreen forest often occupies the ravines in deciduous hill forest, and where such is the case, it often shows a tendency to encroach in spite of annual fires. The latter, unless they occur very late in the season, as a rule only burn as far as the edge of the evergreen, so that the latter continues to grow on unchecked while the deciduous growth is cut back.

J. W. OLIVER.

THE DEVELOPMENT OF THE SAL IN THE DEHRA DUN.—With reference to Mr. B. O. Coventry's letter on this subject in the March number of the present volume Mr. W. R. Fisher writes to us as follows from Coopers Hill:—"I remember, in 1879, seeing an area of sal forest in the Goalpara Division of Assam, where the sal trees were killed by the passage of a new irrigation canal. The damming of the water near the foot of the hills, and the flow

of the canal through the higher land above the natural water course, had raised the level of the sub-soil water on both sides of the canal, and this killed all the sal trees within a certain distance of the canal throughout its passage through the sal forest. This tends to confirm Mr. Coventry's views about the necessity of good sub-soil drainage for the well-being of sal."

THE FAUNA OF CHITRAL.—A correspondent of the *Civil and Military Gazette* writes—As little is yet known about the fauna of the Chitral Valley, I give below a copy of a list showing the names of most of the animals and birds to be met with in those parts. Mammals :—Markhor (*Capra megaceros*), ibex (*Capra sibirica*), oriole (*Ovis cycloceros*), muskdeer (*Moschus moschiferus*), black bear ; and in Upper Chitral the brown bear, leopard, lynx, wildboar, wolf, foxes, jackal (the latter being rather scarce), monkeys in certain nullahs, flying-squirrels, otters, pinemarten, hare, tigercat and porcupine. Birds :—Monal pheasants, the coclos pheasants, ram-chukor, chukor, ducks of various species, the swan in Upper Chitral, woodcock, snipe, quail, pigeons, doves of two species—the ring and the turtle—starlings, hawks of many species, the golden and other eagles, owls, parraket, ravens, rooks, choughs, the golden oriole, magpies, cuckoo, minas, the Himalayan tree and the common house sparrow, wood-peckers of many species, bulbul, the Egyptian vulture, the heron, the blackbird, and the paradise fly-catcher. There are many other smaller birds too numerous to detail.

PROMOTION IN BURMA AND INDIA.—In reply to the letter upon this subject which appeared in our February issue "Taw Kwe" writes to us—" Suppose I am B and have reached, after 16 years' more or less continuous fever, the proud position of 3rd grade Deputy Conservator of Forests and stand top of my grade on the Burma list. A 1st grade Deputy from Burma goes to officiate as Conservator but is replaced by a 3rd grade Deputy senior to me from India ; the latter stays one year and then on the return of the 1st grade Burma Deputy the Indian man goes back to India. I have according to "Another Burman" no cause to grumble. I have lost only Rs. 150×12 . Well ! well ! I am not Job.

SILK CULTIVATION IN CEYLON.—The results of recent experiments have proved conclusively that silk of excellent quality can be raised in Ceylon, and samples of cocoons raised at Pera-deniya from European seed were classed by a European expert as second only to the best Italian silk. Hitherto all experiments have been on a small scale, limited partly by the comparative scarcity of mulberry trees. The time seems now to have arrived when more extensive operations might be undertaken ; and, with this object, it is proposed that an experimental silkworm-rearing establishment be created. A detailed estimate of the cost of the equipment of a small sericulture farm has been obtained from the Inspector-General of Agriculture in India. This estimate does not take into consideration the cost of land or of erection of buildings ; but places the cost of furnishing and machinery at Rs. 3,780 for an establishment of 10 acres. The recurring expenses are roughly estimated at Rs. 50 per acre per annum. The scheme is under consideration by the Ceylon Board of Agriculture.

A NEW METHOD OF FIRE PROTECTION.—We publish the following proposal sent to us under the above title by F. G. It is, we think, unlikely that many Forest Officers will agree that F. G.'s "system" is either advisable or practical.

"A good many years ago I was in charge of a district where the forests were regularly burnt from end to end once, and parts of them twice, according as the fall of leaves allowed. By May not a seedling was to be found from one end of the district to the other, unless perchance in secluded nooks where cattle and fire seldom penetrated. Under these circumstances I asked my Conservator to let me try if we could not hoist the villager with his own petard, at the same time securing a little regeneration for ourselves. It was a bold plan and sanction was refused. The idea was, so far from discouraging incendiaries, to steal a march on them by premature operations. My fire-guards would have been ordered to set fire *wherever they could at the earliest possible moment*. Long before the present fire season, they should be going about in search of the localities where the tops and leaves of the grasses would

burn, leaving the stalk for some weeks later. In this way there would be a continual series of comparatively harmless fires, and a complete absence of the big ones that destroy woody vegetation. The system would apply in all ordinary grasses of moderate size, and even in giant grasses when the clumps are scattered and have not yet formed a solid mass. The question of grazing need not be considered, for the people themselves deliberately fired the forests as often as they could. It kept tigers away, ensured their privilege of gathering deadwood, etc., etc., *ad libitum*.

"I should like to invite discussion of the plan so as to learn whether others think it might be given a trial or not."

THE DEVASTATION OF THE FORESTS IN WEST AFRICA AND DIMINUTION IN THE WATER-SUPPLY.—General Kemball, Inspector-General of the West African Frontier Force, who has returned to England from a six months' journey, says that one of the great problems of West Africa is the question of the depletion of the forest and bush region, which is generally held to be the cause of the growing scarcity of water in the dry season. The French, he says, are of opinion that the volume of the Niger is diminishing, and that the Sahara desert is slowly extending southwards.



E. M. Hodgson, Photo.

The 100-foot cut fire line separating the British and Baroda State Forests.

THE PRESENT AND FUTURE POSITION OF THE INDIAN FORESTER.

The *Indian Forester* was given over by Mr. Gamble to Mr. Oliver in trust for the members of the Department. On the resignation of the latter the management was undertaken by a Committee of three, one of whom has now gone on long leave, and another will, it is understood, be shortly leaving India. It is thus felt that some permanent arrangements should be made for carrying on the magazine and guaranteeing its existence. In order to ensure this it is thought that a Board of Management, consisting of five members, including the Inspector-General of Forests as President, *ex-officio*, is the best solution—this Board to make itself responsible for the efficient control and to look after the financial position of the *Indian Forester*.

In order to make this Board of Management representative it has been considered advisable to form it of officers of the rank of Conservator if possible, otherwise of Senior Deputy Conservators, Bengal supplying two members, Madras one, and Bombay one.

To give effect to this Messrs. Gleadow, Brasier, and Mercer have been asked and have agreed to serve. They will form the Board of Management together with Mr. Manson, a member of the old Committee of Management, with the Inspector-General of Forests for the time being as President, *ex officio*. The latter will take no part in the executive management or control, although as President he will have a voice in the election of the members of the Board and of the Editor when vacancies occur. The Editorship will remain with Mr. Stebbing, who has kindly consented to serve subject to the control of the Board.

To make matters clear it may be stated that on the resignation or departure from active service of a member of the Board, the latter with the remaining members will choose his successor. The Trustees will allow the Editor all reasonable latitude in the production of the magazine, and will publish an annual balance sheet for the information of all subscribers.

The present position is very sound financially.

All articles for insertion should, as heretofore, be sent to the Editor, or, if preferred, to any member of the Board: in no case will the name of any contributor be given up, should he wish to remain anonymous. His name must, however, be communicated to the Editor or any one member of the Board as proof of good faith, though no responsibility is accepted for the opinions expressed. Signed articles will be either inserted verbatim, or refused, should the Editor or any member of the trust consider that their tone is open to objection or that they exceed the limits of fair criticism. Should any contributor consider himself aggrieved he has the right to appeal to the Secretary of the Board, who will lay his complaint before the members of the Board.

The desire is to keep the magazine entirely independent, and every endeavour will be made to do this; it is hoped therefore that anyone wishing to contribute articles bearing in any way on the welfare of the Department, or on any subject that he thinks may be of interest to its members, will do so without hesitation.

As Mr. Mercer is on the spot close to the headquarters of the Honorary Editor, he has consented to act as Honorary Secretary for the time being of the Board of Management.

INDIAN FORESTER

AUGUST, 1905.

A SUMMARY OF THE OBSERVED RESULTS OF FIRE PROTECTION IN TEAK FORESTS.

During the past two years various letters have appeared in this journal on the subject of fire protection in teak forests, these communications mostly coming from officers in Burma. As the information thus given is scattered over many numbers and buried in a mass of theory, it appears advisable to summarise the facts that have been proved as apart from the theoretical views, and to try and see how further facts can be obtained to put an end to the differences of opinion which exist on a subject which is of far too great importance to be left in its present position.

As regards the germination of the teak seed, the observations of all officers show that the access of direct heat and light from the sun are required for successful germination, and that these conditions can generally, for financial reasons, only be obtained over large areas by the action of fire in removing the heavy covering of leaves and herbaceous growth. The experiments carried out in Katha proved that successful germination follows this removal without further action. It has also been shown by experiment that the slight scorching caused by a mild fire improves or, at any rate, hastens germination, and the larger number of seedlings in unprotected forests has not only been observed by most officers but was markedly demonstrated in the comparative countings carried out by Mr. Troup in Tharrawaddy. These countings were carried out over two exactly similar forest areas, one of which had been fire protected since 1872-73 (and successfully so since 1888 at least), while the other had never been protected. Bamboos had been cut heavily in both, and the fire protected area also had the

advantage of improvement fellings having been carried out twice. Despite this it was found that the protected area only had 62 seedlings per 50 acres, while the unprotected area had 616 over the same acreage.

After the seed has germinated the effects of the fire get more complicated. The Katha experiments showed that if the heavy fall of leaves in the year succeeding germination was allowed to remain lying on the seedlings, the latter became etiolated and weak in their efforts to find a way through, and either died off or persisted for a short time as weak straggling shoots. Burning the leaves back gives the seedling a chance as, although the shoot of the seedling also gets burnt, the succeeding shoot is stronger and more able to take care of itself. Unfortunately observation shows that in many cases this burning back causes an injury to the stock. Opinions differ as to the permanency of this damage, and as to whether it commences with the youngest seedling or not till the shoot of the latter is of a woody nature. Some officers hold that this is the main, indeed the only, cause of the hollow trees so frequently found, while others hold that if this early burning had a permanent effect we should not find a single sound tree in the forest.

The fact that seedlings receive a certain amount of damage which would be avoided by protection, is certainly proved, but further evidence is required as to whether this damage is of a permanent nature and the main cause of unsound mature trees. As teak is a light demander and as protection increases the shade, protection must to a certain extent be detrimental to the development of the seedling.

The effect of fire on saplings and poles has not called forth many observations, but they seem to suffer little from the actual fire, while the figures collected by Mr. Troup in Tharrawaddy show that they suffer from protection which encourages the growth of bamboos, and thereby aids suppression. His figures show that over equal areas of 50 acres there were 198 sound and 230 unsound or dead poles and saplings in the protected area, while in the unprotected area there were 276 sound and 66 unsound or dead

ones, the smaller number of dead ones in the latter area being probably due to their getting burnt. The difference is even more marked when it is considered that the majority of the sound poles in the former area are still in danger of suppression while those in the latter are vigorous and out of danger; suppression and not fire is definitely stated as the cause of the unsoundness noted. It must however be borne in mind that in both protected and unprotected forests the saplings will suffer greatly from suppression unless the cover is artificially lightened by bamboo cutters or paid labour, or is naturally lightened by the death of the bamboos.

The damage done by fire to hollow trees and to trees with defective bark covering is shown, by general observation and the figures collected for working plans, to be great, but further proof seems to be wanting as to the origin of the above damage. Were the hollows in the trees originally started by the burning back of the seedling or by the suppression of the sapling? Did the side defects occur through constant fires acting on a healthy tree, or did they not commence till the tree began to deteriorate from age? These points require working out, and then the question arises, is the amount of damage done sufficiently great to be worth the expenditure incurred on protection? Figures collected by Mr. Rodgers show that out of the trees girdled by him 8 per cent were commercially damaged and 52 per cent damaged so as to impair their vitality: these figures are incomplete as they take no account of the sound trees left for regeneration or of the unsound left as unmarketable, and they also assume that all the damage was done by fire. However, calculations based on these figures tend to show that the value of timber lost is not equal to the cost of protection. Thus the late Mr. Slade showed that on the assumption that 25 per cent of the timber was damaged, the annual damage per square mile amounts to Rs. 4-12-0, which is much less than the cost of protection, while Mr. Walker, using the same figures and assuming a certain percentage of timber as damaged, found that in 13 working circles out of 16 the cost of fire protection was more than the value of timber which would be saved. As both these results depend on an assumption of the

amount of damage, they cannot be fully accepted without further observation.

The effect of fire protection on the forest generally has been proved to enormously increase the undergrowth and the amount of débris on the ground, while observations have also shown that it does not result in the formation of humus, the reason probably being that the leaves in which humus should form are immediately eaten and destroyed by insects and worms, and thus taken below the surface of, and incorporated with, the soil. Now, as far as the experiments have gone, has it been shown to improve the rate of growth of the teak? Its effect on the multiplication of insects cannot be estimated until the life-histories of the latter are better known, but the accumulation of woody débris points to the increase of insects living on the same.

In order to arrive at a conclusion on the points which have been shown as still doubtful, careful enumerations of teak on as varied areas as possible should be made. In these enumerations the greatest care should be taken to note the amount of damage and its causes and the signs of deterioration in all age-classes, and not only in the 1st-class trees. This should be done in both protected and unprotected areas, and a careful comparison of the results would allow most valuable conclusions to be drawn. At the same time observations, microscopical and otherwise, might be made on felled saplings to prove the existence or reverse of damage done to the seedling. Observations now being made on the life-history of insects should soon settle the effect of fire protection on their multiplication. When we have got the further information indicated above, we shall be able to estimate the comparative value of protection and non-protection in teak forests, and in the meanwhile we would ask the more impetuous of the opponents of protection to remember the late Mr. Slade's advice, that they should not let their feelings carry them away so as to brand all fire protection as pernicious. Study moderation and see how fires can be controlled so as to yield the maximum benefit and the minimum damage therefrom.

SCIENTIFIC PAPERS.

THE RIPENING OF THE CONES OF *PINUS LONGIFOLIA*.

ON THE FORMATION OF PSEUDO-CONES OR GALLS.

BY BABU BIRBAL.

This subject has been discussed in the pages of the *Indian Forester*; and I now beg to give below the results of my further researches on this subject.

1. In April 1903, Vol. XXIX, page 276, Mr. E. M. Coventry wrote a note on the subject of the ripening of the cones of *P. longifolia*, in which he said "There appears to be a mistake in Gamble's *Manual of Indian Timbers*, page 706, regarding the period necessary for the cones of chil (*P. longifolia*) to ripen; this is given as 15 months, but I think it should be a year longer." He also wrote, "according to Kangi Lal's 'Flora of the School Circle,' the chil (called chir in that circle—Hon. Ed.) flowers in February—April and the seeds are shed in October next year. In this Division (Kangra) the seed falls from the cones in May."

2. To this letter I replied in July 1903, page 407, that the fruit takes 12 to 15 months to ripen and the seeds are wholly shed in May of each year in Dehra Dun, and that there is an exception to this rule; that the cones of which the ovules are not fertilised being weakly ones do not open and therefore cannot shed their seeds and remain unopened on the trees and during the rains decompose or decay.

I asked Mr. Coventry to send me specimens of cones which take $2\frac{1}{4}$ years to ripen in order to enable me to ascertain their age.

3. In December 1903, page 572, Mr. Coventry, in reply to my letter, wrote "Last year's shoot terminates in a bud. In March or April this bud expands and develops into a shoot, which bears at or near its extremity the young cones. When the shoot has expanded to its full length, it is found to be terminated by a bud, round which the young cones are situated. The male cones are situated on and around the lower portion of the year's shoot and

drop off soon after they have shed their pollen. (Male and female cones do not of course occur on the same shoot.)"

Further on Mr Coventry says, "At this time of year (September) only two kinds of unripe cones are found on the trees, *viz.*—(a) this year's cones at the end of the shoot and surrounding the terminal buds. These are now brown externally but are green within. Next spring when they enlarge they will have the appearance of (2) above. (b) The cones at the base of the current year's shoot. These have nearly reached their full size but are still green except the tips of the scales. They have become fairly hard. I have sent to the Forest School a branch which bears cones (a) and (b). All the Rangers in this district and some zamindars whom I have questioned state that the cones require two years to ripen."

4. In December 1903, page 573, Mr J. C. McDonell, late Conservator of Forests, Kashmir, drew attention to a previous note of his own (*Indian Forester*, May 1886) in which he had drawn attention to the fact that the cones of *P. longifolia* take 29 months to ripen.

5. I answered the above letter, Vol. XXX, page 308, illustrating both kinds of cones by means of photographs showing that the real female cones were at the base of the flowering stock with plenty of male catkins above them to shed their pollen and to fertilize the female cones below them and close to them. I also drew attention to the fact that the female cones of a week old were $1\frac{1}{2}$ inches long and the cones of 2 weeks old were about 2 inches long, and said that the growth of the cones after fertilization was extremely rapid, while the unfertilized cones were very small and were always found on the tips of the flowering shoots, and therefore their fertilization was quite impossible, as there were no male flowers close to them. I also drew attention to the fact that the distance between the cones produced each year was 14 inches; the question was then, how was it possible that the cones on the top of the flowering shoot and those at the base of the same flowering shoot, a distance of $4\frac{1}{2}$ inches, were formed in two different years? That is, that the cones at the base were

fertilized one year and the two cones on the top fertilized the next year, which seemed to me impossible.

In paragraph 8 I said "Now, suppose cones are produced this year and are fertilized next year by new catkins, the distance between the two, as already explained, would be about 14 inches (see figure 13), which is to my mind too far to allow of proper fertilization. On the other hand, in case they be fertilized the same year as they are produced, there is no reason why they should turn hard and brown the first year and become again green and soft the following year and continue to grow, reaching, in a month or so, their full size. It is generally the natural rule that if any fruit is formed it grows regularly to its full size without any intermediate obstruction such as would happen in this case."

I would also draw attention to paras. 9, 10, and 11 of this letter.

6. In September, page 421, Mr. F. B. Manson, Conservator of Forests, in reply to my letter drew attention to a very important fact, *viz.*, that in the case of most *pines* fertilization of the ovules takes place *some time* after the pollen has been shed.

7. I was not satisfied with Mr. Manson's letter, as I still could not understand why ovules of *Pinus longifolia* cones should take one year to be fertilized. I also found it difficult to understand why cones of *Pinus longifolia* should get brown or yellow and decayed in the first year, and then in the following one, as the male catkins appear and the pollen begins to be shed, that the female cones become green and grow in two months or so to their full size and then turn brown and ripe and shed their seeds in May of each year.

I had shown some of the small cones at the top of the shoots to Dr. Butler, Cryptogamic Botanist to the Government of India, and asked his opinion, and he said he thought it might be due to some insect, but that it had nothing to do with a fungus.

I continued my observations till Mr. E. P. Stebbing, Forest Entomologist to the Government of India, returned to Dehra from furlough. I took some of the small cones to him for microscopic examination on the 14th September 1904, and he

examined the cones and found three grubs in one of these so-called cones. The grubs were found at the base of the scales where they were yellowish. Mr. Stebbing said that the cone was a gall or false cone. I took some of the false cones on the 29th September 1904, when they were about $\frac{1}{2}$ inch long and about $\frac{1}{2}$ inch diameter, and put them in an insect-rearing box covered with muslin cloth and labelled them. These cones came to nothing and dried up in course of time. I took others again on the 24th October 1904, they being then about $\frac{7}{8}$ inches long, about $\frac{7}{8}$ inches diameter, with swollen scales of irregular shape, viz., in some places these scales were very thick and in some places the scales were of the same size as on the 29th September. On the 29th November 1904, four flies issued and a number of grubs came out of the cones and turned into cocoons in about two days. On the 29th November 1904 I took a number of these galls and placed them in the insect-rearing boxes. On the 5th December 1904, lots of grubs came out as the galls were opening and many of the grubs turned into cocoons on the 6th December 1904, that is, in two days only.

I had also numbers of these cones enveloped in muslin cloth bags on the trees, and the grubs came out of the galls in the same manner as in the boxes and formed cocoons on the cloth and galls itself but not in the galls.

The flies began to issue from the cocoons on the 28th February 1905 and continued to issue till 19th March 1905. These are of two kinds, one with yellow legs and one with colourless legs.

In conclusion I beg to say that these galls of *P. longifolia* are formed on the needles and on the tip of the flowering stalks, and not in the male flowers. Figs. 12, 13 and 14 of my article in the *Indian Forester* for July 1904, page 108, will show that these so-called cones began to form when the male catkins had disappeared and the needles had begun to form. The real cones are to be found at the base of the flowering stalk and close to the male catkins, as figs. 1, 2 and 3 show.

8. The first appearance of the real cones of *P. longifolia*, which are then green, was observed on the 10th March, and by the

end of May they had nearly reached their full size but were still green, that is, in about three months. The seed is collected in the following May, as we have been doing during the last 20 years.

In conclusion I trust the above note will finally set at rest the vexed question of the ripening of *P. longifolia* cones. Mr. Stebbing has kindly promised to write a note upon the insects.

ON THE CECIDOMYID (CECIDOMYIA (?) SP.) FORMING THE GALLS OR PSEUDO-CONES ON *PINUS LONGIFOLIA*.

BY E. P. STEBBING.

Although I had followed the correspondence carried on in the columns of the *Indian Forester* on the subject of the ripening of the cones of *Pinus longifolia*, assuming the question to be rather a botanical than an entomological one I made no special study of the cones until Babu Birbal brought me some to examine on September 14th, 1904. I propose to deal here with the results of that examination and with the discoveries which Birbal's subsequent investigations, in which I was able to take part up to the end of the year, gave rise to.

A careful dissection, on September 14th, of several of the cones failed at first to show anything in the nature of an insect within them, although the structures, whilst very far from being so obviously galls as is the case, e.g., with the Himalayan Spruce gall (*Chermes abietis-picea*), nevertheless certainly had not the appearance usually pertinable to cones. Closer examination finally brought to light some minute colourless grubs feeding in the mass of tissue which composes these structures. These larvæ under the microscope proved to be very immature maggots, apparently dipterous.

This settled the question as to the real nature of these structures which had up to now been taken to be cones or aborted cones, and steps were taken by Babu Birbal to keep them and the trees bearing them under a strict surveillance.

An examination of some of the galls the following month showed that they had slightly increased in size whilst the grubs were also slightly larger. Towards the end of November the larvæ commenced to reach maturity, and at the end of November

and through the first week in December they were to be found leaving the galls and crawling to the outside to pupate. It was at the end of November that it was first discovered that there was apparently another insect present in addition to the one responsible for the formation of the pseudo-cones, a hymenopterous fly, evidently parasitic upon the gall-maker; a fly issued from one of the galls. This fly will be alluded to at a later stage of this note. Babu Birbal obtained the real gall-makers at the end of February, and I was able to determine them as a species of Cecidomyiid.

Before dealing more fully with the life-history of this minute pest, as far as it is at present known, it will be necessary to describe the various stages of the insect obtained.

CECIDOMYIA (?) sp.

THE LONG-LEAVED PINE GALL-FLY.

Larva.—When examined in September the grub is a minute colourless maggot pointed at both ends, with a few small tubercles on it.

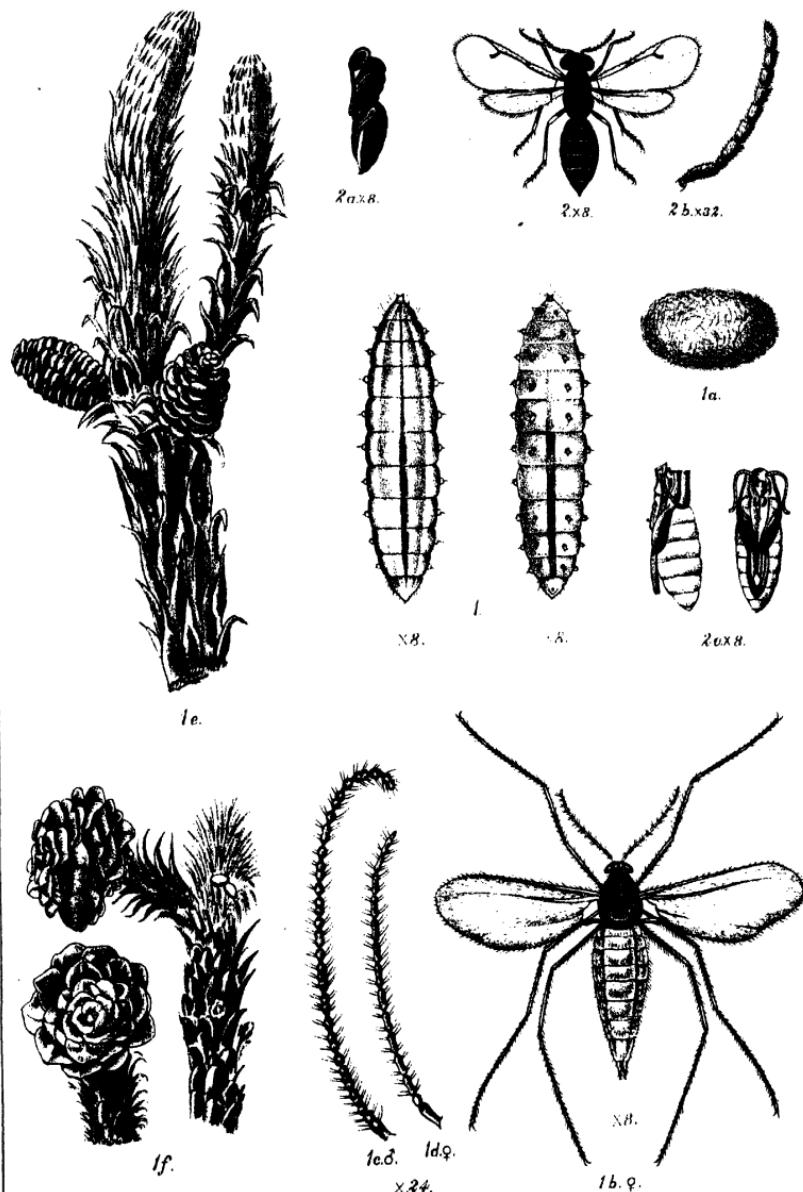
When full-grown the maggot is yellow to orange in colour, elongate-elliptical, flattish, the segments being set with numerous prominent tubercles; length 4·7 to 5·4 millim.

Plate XXXVIII, fig. 1, shows a dorsal and ventral view of this grub.

Cocoon and Pupa.—When full-fed the larva leaves the gall and crawls to the outside and pupates there, forming a glistening white cocoon of a curious close matty substance. Within this the maggot pupates, the pupal skin being yellowish to yellowish-brown. The outer surface of the cocoon subsequently changes to yellow; length 3·2 millim. (Cf. figs. 1 a, 1 f.)

Imago.—A small delicate greyish fly with black eyes, long antennæ and very long legs.

Head small, black, with prominent eyes; antennæ long and furnished with whorls of simple hairs. The thorax is blackish-grey, broader than the head and bears the three pairs of long legs and a pair of delicate membranous wings which have only two main nervures in them, the upper being the stouter; the halteres are long, the capitate body not being prominent. The abdomen is



S. B. Mondul, del.

Lith: by S. C. Mondul.

The long-leaved pine gall-fly and its parasite.

fairly stout, elongate, convex above, the first segments broadening out to 4th, which is broadest, and then constricting posteriorly; colour greyish with darker markings above; lighter coloured below. Legs grey and very long. Wing expanse 6·25 millim.

The antennæ in ♂ are 24-jointed, in ♀ 14-jointed, and shorter than in male. The male antennæ are curious in that many of the joints appear double or treble owing to constrictions in the joints themselves. Fig. 1 b shows a dorsal view of this insect, enlarged. Fig. 1 c shows an enlarged antenna of the male and 1 d of the female insect.

LIFE-HISTORY.

The eggs are evidently laid by the fly in the axils of the bud scales at the end of the shoot. In the long-leaved pine there is a terminal bud surrounded by 5 to 7 others. Three, four, or more of these may have eggs (or an egg) laid on them in this way: The larvae on hatching out commence to feed in the green tissues and set up an irritation which evidently leads to the young needles swelling up and coalescing, thus forming the young gall. In September these galls are barely half an inch in length by one-third in breadth (*vide* fig. 1 e, which shows two of the galls). Externally they have the appearance of small cones, the minute scales being narrow and triangular shaped, the beak bluntly pointed. Sections cut through them fail to show any system of compartments, but merely a mass of green resinous tissue of considerable density. In this mass the young larvae are living and feeding. At this period the maggots are only just visible to the naked eye. During October they increase in size, become yellowish in colour, and are to be found feeding at the base of the scales, embedded in a mass of turpentine. By the end of the month the larger of the galls are about $\frac{3}{4}$ inch in length, the scales having swollen on one or more sides to a considerable extent, their upper margins turning slightly over and downwards. The cones are elliptical or ovoid in shape. During November the grubs complete their growth in size, and towards the end of the month commence to leave the cones. These latter are by now just under the inch in length and about $\frac{3}{4}$ inch in breadth, the size of course varying. The scales have

swollen up to such an extent that their upper edges have deflected completely downwards, rolling up on to the under surface beneath (*vide* fig. 1 f). A large amount of turpentine and resin is exuded at this period, the whole forming a sticky mass. The grubs now crawl out from the interior of the cone and proceed to pupate either on the gall itself or they crawl to any neighbouring dwarfed buds and pupate amongst the scaly needles or amongst the scales on the twig itself. This wholesale exit on the part of the grubs is a most curious sight to watch and a peculiar feature of the life-history of this insect. It is doubtless determined by the fact that if they remained within the gall the mass of turpentine it now contains would on congealing eventually prevent the egress of the delicate flies. From Birbal's observations it apparently takes the grubs two days to perfect their cocoons, the external coating of which is not unlikely to be found to be some sort of exudation. The grubs began to issue from the galls on the 29th November and continued to do so until the 10th December, by which date all had pupated. They moved about very slowly, seeming to slowly glide or slide along in the turpentine which coated the galls. These latter covered with the bright yellow grubs presented quite a remarkable sight.

The first flies issued on the 28th February and continued to issue until the 19th March, the pupal stage thus lasting some three months.

The gall quickly dries up after the grubs have left it, but persists on the tree for a considerable time.

The life of the fly after issuing is probably a very short one, and the eggs are deposited, as above-mentioned, down at the base of the scales on the young buds of the year.

Although, owing to Babu Birbal's commendable persistency in continuing his investigations into the real nature of these cones (false cones as it turns out), we are now in possession of a considerable proportion of the life-history of this insect, indefiniteness still enshrouds other portions. We have yet to find out when the eggs hatch out and how long the larvae take to form the pseudo-gall. The long-leaved pine puts forth its new shoots in March in

Dehra, and therefore long ere this the eggs must have hatched and the young larvæ have commenced to feed upon and abort the buds containing the new needles. The curious point, however, is that if the larvæ commence work, as is most probable, in April, how is it that the young cones are still so small in September, and also how is it that the maggots themselves are so tiny in this month? A possible explanation of the latter is as follows:—In the case of some cecidomyiid flies the females lay a few very large eggs, out of each of which comes a larva. This latter produces in its interior young larvæ which, after consuming the interior of the body of the parent, escape by making a hole in the skin, and thereafter subsist outside in an ordinary manner. Whether such a state of affairs applies to the *P. longifolia* cecidomyiid gall has yet to be ascertained.

THE INSECT PARASITIC UPON THE *P. LONGIFOLIA* CECIDOMYIA.*

I have alluded above to the fact that two insects were found in the pseudo-cones. The second one proved to be a parasitic hymenopterous fly* belonging to the family *Chalcidae*.

TRIGONOMERUS SP.

A small brilliantly coloured fly. Head metallic coppery-green with a brilliant iridescence, eyes large, blue-black, antennæ 10-jointed, dark brownish-black, thickly clothed with a short whitish pubescence, 1st joint longer than 2 and 3 together, scimitar-shaped, yellow, 2, very short, globular, 3, longer, broad, truncate at top, rest shorter than 3, subequal, except 9, which is slightly longer, truncate, 10 shorter than 9 and produced to a point at tip. Thorax metallic coppery with a brilliant iridescence and greenish sheen; deeply channelled, rugulose, with a few large shallow punctures. Wings yellow and iridescent. Body dark blue-black. Under surface coppery; body blue-black. Upper and under surface with a sparse short stiff white pubescence. Legs canary yellow, pubescent. Wing expanse, 2·34 millim.

Fig. 2 shows a dorsal view of this insect, 2 a, a side one, and 2 b an antenna greatly magnified.

* This fly has been very kindly identified for me by Col. C. T. Bingham as an undescribed species of *Trigonomerus*.

Pupa.—Figure 2 c shows a dorsal and side view of the pupa of this insect. The pupa is whitish-yellow with black markings.

LIFE-HISTORY.

Beyond the dates of emergence of this fly and its evident parasitic nature upon the *Cecidomyia* we know little about the life-history of this useful insect.

Babu Birbal mentions obtaining four flies from the cones on the 29th November. As however only one of the flies was secured and subsequently identified, the rest getting away, the latter must be eliminated from the enquiry altogether. No further flies emerged until March, when they issued in conjunction with the *Cecidomyia*. I am quite unable to account for the emergence of the November fly, as it would appear, according to the dates of emergence of the others, to be quite abnormal, and moreover equally useless since in November-December there would evidently be no *Cecidomyiid* eggs or larva for it to lay on or in.

EXPLANATION OF PLATE.

Cecidomyia (?) sp.

- Fig. 1. Dorsal and ventral view of larva.
- 1a. Cocoon.
- 1b. Imago dorsal view
- 1c. Antenna of male.
- 1d. Antenna of female.
- 1e. Branch of *P. longifolia* showing two pseudo-cones in October.
- 1f. Side and front view of fully grown galls. The small white oval bodies seen on the scales and on the spiny tuft to left are cocoons.

Trigonomerus sp.

- Fig. 2. Dorsal view of imago.
- 2a. Side view of same.
- 2b. Magnified antenna.
- 2c. Ventral and side view of pupa.

The sizes of the magnifications, if any, are shown by small numbers against the figures.

ORIGINAL ARTICLES.

THE EFFECTS OF THE GREAT FROSTS ON THE FORESTS OF NORTHERN INDIA.

A NOTE ON THE EFFECTS OF THE ABNORMAL FROST ON THE FORESTS OF THE DUN.

BY E. R. STEVENS, I.F.S.

OFFG. DEPUTY CONSERVATOR OF FORESTS, DEHRA DUN DIVISION.

About seventy-five per cent of the forest-clad area of the Dun suffered considerably from the abnormal frosts during January and February of this year.

The damage naturally varies much with differences in aspect, density of the crop, and especially in elevation.

Only the tree growth on the higher slopes of the Siwaliks escaped injury altogether, and during March and April before the outburst of the fresh flush of sal leaves the frost limit was curiously and sharply defined by the dead and brown foliage of the greater mass of the forest suddenly giving place to a belt of green lining the upper slopes to the watershed.

With due regard to the varying intensity of the damage owing to the above mentioned factors it may be said that all young woody growth with but a thin protective layer of bark has been destroyed. This refers to the sal and its congeners with the exception of *Ougeinia dalbergioides*, *Dalbergia sissoo*, *Cedrela toona*, and *Mallotus philippinensis*, which suffered no serious injury. Thus the twigs and thinner branches of the older trees have been killed, and these trees now present a stag-headed appearance with the new foliage covering the main branches.

Poles from 1 to 2 feet in girth have been killed to within 5 to 15 feet from the ground, while those under 1 foot in girth have been killed to within a few feet from or down to the ground itself. New shoots are now being freely sent out below the dead wood, which will result in a large number of pollards, and as regards the future quality of the forest, this partial dying of the stem is the

most to be deplored : those stems which have been killed down to the ground are now sending up strong shoots from the roots

Coppice areas have naturally suffered very severely.

Young seedlings in fairly dense forest seem to have mostly escaped.

The injuries that the forests have sustained must represent the loss of at least 10 to 15 years' growth.

ON THE EFFECTS OF THE FROSTS ON THE TREES IN THE
SAHARANPUR FORESTS.

BY E. A. COURTHOPE, I.F.S.

ASSISTANT CONSERVATOR OF FORESTS, SAHARANPUR DIVISION.

In the early part of this year, 1905, the Saharanpur District, in common with all Northern India, was visited by a spell of severe frost, almost unprecedentedly low temperatures being recorded. The immediate effect of this on forest growth was seen in the withering up of the leaves of trees of almost all species. This was most noticeable at the lower elevations, all the plains forests presenting a uniform brown appearance. From the foot of the hills, as the elevation increased more green trees appeared until near the ridge the effects of the frost could be seen but slightly. Viewed from a distance this counter influence of elevation against the destructive effects of the frost was most marked, the green and withered trees appearing to be separated by a clearly defined line along the hill side.

It was not until about May, however, that it was possible to form any correct idea of the extent of the damage. Then it became possible to see what trees were dried up completely, root and branch, what trees had been partially damaged, and what trees had escaped altogether.

The effects of the frost on sal poles, saplings and seedlings, which form by far the greater part of the sal stock in the Division, have been most disastrous. Even as the first effects were most noticeable at the lower elevations, so here too the permanent damage proved worst, being most conspicuous at Dholkhand, the central range of the Division. The seedlings have dried up altogether, the saplings have either dried from the ground upwards, in which

case they are sending out shoots from their roots, or they have been killed from the crown down to a varying distance, in which case their boles are surrounded by a mass of epicormic shoots, above which the dry stick which formed the leading shoot before protrudes. The poles are in very many cases damaged in the same way. The older trees now show no effects at all.

It still remains doubtful what the after effects of this damage will be. It is stated by some that when the dried part falls off, one of the epicormic branches will assume the lead, in which case after a few years very little perceptible difference would be seen. Others believe that several of the epicormic shoots will assume the lead simultaneously, thus causing a sort of pollard.

The sal has been made the chief subject of this note, as it is the most valuable species in the Division, and naturally more attention is paid to it.

The other species suffered most in the rather open plains forests, and least where they were growing mixed with sal. A list showing the comparative damage done to them is appended below.

The effects of the frost in the coppiced areas is more evenly distributed over the Division. In all the more recently felled areas the shoots of most species have been killed back, and new shoots are now appearing. The damage will be imperceptible after a few years. In the older coppices there is, I think, very little permanent damage, only a few trees here and there having been killed.

In some places this year's bamboo shoots have suffered and are drying up.

Another effect on the forest has been found in the absolute dearth of seeds of all kinds in the Dholkhand Range, while in the other ranges they are very scarce. This is due, of course, to the fact that the inflorescence was killed at the time of the frost. For this reason, too, there is but a small quantity of honey in the forests this year, for, while probably many of the bees died from cold, the survivors have not found sufficient flowers for the production of the usual quantity of honey.

The following is a list of those trees which have suffered most :—

Sal	...	Shorea robusta.
Chilla	...	Casearia tomentosa.
Pial	...	Buchanania latifolia.
Amaltas	...	Cassia fistula.
Ambasa	...	Spondias mangifera.
Kharpat	...	Garuga pinnata.
Bhandair	...	Zizyphus xylopyra.
Kura	...	Holarrhena antidysenterica.
Jingan	...	Odina wodier.

The following have suffered in a less degree :—

Khair	...	Acacia catechu.
Aonla	...	Phyllanthus emblica.
Pula	...	Kydia calycina.
Dhak	...	Butea frondosa.
Tendu	...	Diospyros tomentosa.
Jaman	...	Eugenia jambolana.
Shisham	...	Dalbergia sissoo.
Hald	...	Adina cordifolia.
Pipal	...	Ficus religiosa.
Bargat	...	Ficus bengalensis.

NOTES ON THE EFFECTS OF THE SEVERE FROST ON CERTAIN TREES AND SHRUBS IN THE AGRI-HORTICULTURAL GARDENS AT LAHORE.*

The effects of the severe frost were very noticeable on many trees and shrubs of large size which hitherto have not been affected, and many trees and shrubs suffered very severely.

The following trees and shrubs which ordinarily are never affected by frost were slightly damaged, but will recover :—

TREES.	SHRUBS.
Michelia champaca.	Heliotropium,
Pterospermum acerifolium.	Artobotrys odoratissima.
Bursera serrata.	Hibiscus splendens.
Saraca indica (asok).	Sophora japonicum.

* Communicated by the Inspector-General of Forests.

TREES.	SHRUBS.
<i>Barringtonia acutangula.</i>	<i>Rondeletia speciosa.</i>
<i>Ficus religiosa</i> (pipal).	<i>Jacaranda mimosifolia.</i>
<i>Brachychiton acerifolium.</i>	<i>Cestrum nocturnum.</i> [chanana].
<i>Bombax malabaricum</i> (simal).	<i>Tabernæmontana coronaria</i>
<i>Ficus indica</i> (bor).	
<i>Bassia latifolia</i> (mowa).	
<i>Butea frondosa</i> (chichra).	
<i>Aleurites moluccana</i> (bahera).	

The following trees and shrubs which in previous years have been slightly affected have been killed or very seriously damaged :—

TREES.	SHRUBS.
<i>Melia indica</i> (neem).	<i>Heliotropium</i> (English).
<i>Aegle Marmelos</i> (bil).	<i>Acalypha</i> of sorts. .
<i>Ficus elastica</i> (rubber).	<i>Clerodendron infortunatum.</i>
<i>Sterculia alata.</i>	" <i>odoratum.</i>
<i>Inga dulcis.</i>	<i>Coleas</i> of sorts.
	<i>Hibiscus igora.</i>
	<i>Gmelina parviflora.</i>
	<i>Iresine</i> of sorts.
	<i>Allamanda</i> of sorts.

The following have been badly damaged, but will eventually recover :—

TREES.	SHRUBS.
<i>Saraca indica.</i>	<i>Dracæna terminalia.</i>
<i>Bursera serrata.</i>	<i>Plumaria</i> of sorts.
<i>Kigelia pinnata.</i>	<i>Plumbago capensis.</i>
<i>Dillenia indica.</i>	<i>Cestrum nocturnum.</i>
<i>Croton longifolia.</i>	<i>Bauhinia vahlii.</i>
<i>Ficus roxburghii.</i>	<i>Bougainvillea</i> of sorts.
<i>Pongamia glabra.</i>	<i>Bauhinia alba.</i>
<i>Ficus glomerata</i> (gular).	<i>Hibiscus</i> of sorts.
<i>Albizia procera</i> (safed siris).	<i>Tabernæmontana dichotoma.</i>
<i>Cassia fistula</i> (amaltas).	<i>Jasminum grandiflora.</i>
<i>Tecoma mollis.</i>	<i>Poinsettia pulcherrima.</i>

TREES.	SHRUBS.
Pterospermum acerifolium.	Dodonaea viscosa.
	Duranta of sorts.
	Hamelia patens.

The following trees and shrubs were unaffected by the frost :—

TREES.	SHRUBS.
Pistacia integerrima (rhus).	Lagerstroemia rosea.
Cedrela toona.	Gardenia of sorts.
Brachychiton populim.	Buxus nepalensis.
Eucalyptus of sorts.	Rhamnus utilis.
Grevillea robusta.	Myrtus communis.
Ficus retusa.	Ligustrum lucidum.
Millingtonia hortensis (bakain).	Magnolia grandiflora.
Putranjiva roxburghii (patazan).	Sophora secundiflora.
Sterospernum suaveolens.	Callistemon of sorts.
Platanus orientalis (chinar).	Enenymus japonicus.
Terminalia of sorts.	Flacourtie.
Camphora officinalis (kafur).	Nerium of sorts.
Pinus longifolia (cheel).	Jasminum humili (chambeli).
Cupressus of sorts (saru).	
Juniperus prostrata.	
Thuja of sorts.	
Ceratonia siliqua.	

FIRE PROTECTION IN THE MANDUI RANGE, SURAT DISTRICT.

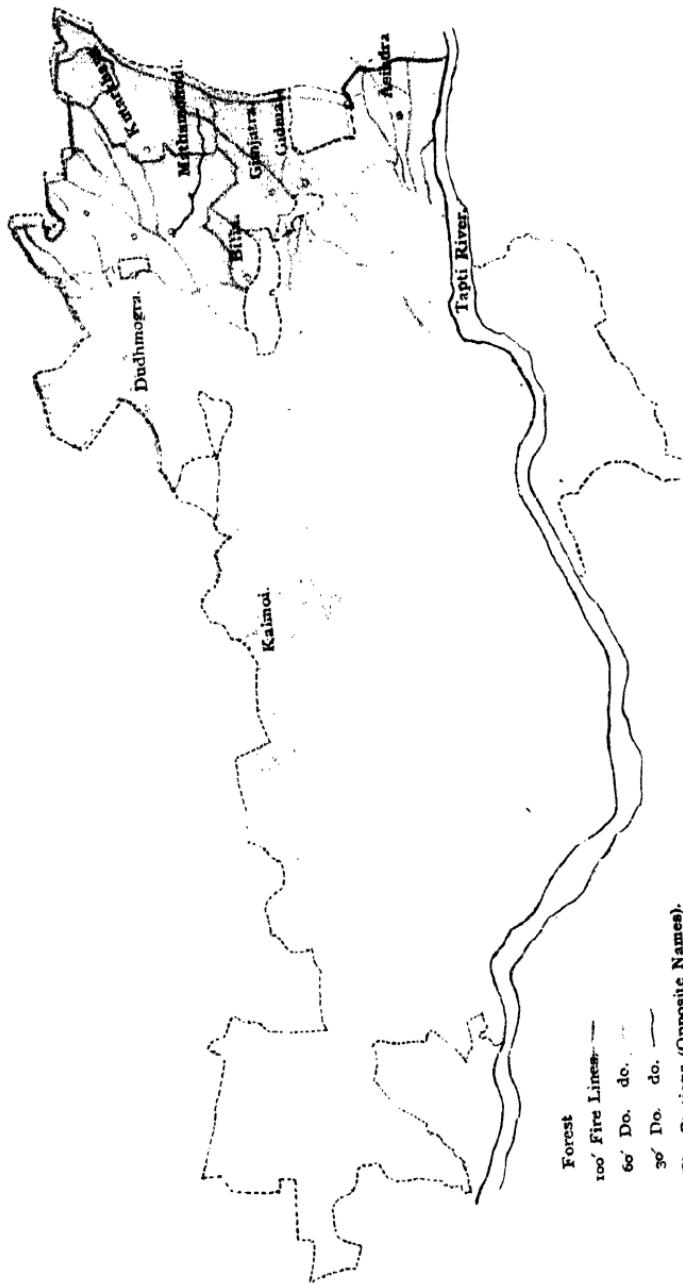
BY E. M. HODGSON, I.F.S.

At the request of the Honorary Editor, the following account of fire protection in the Mandui Range has been written, and will, it is hoped, prove of some interest, and possibly even of use also.

To begin with, there is nothing original in the scheme of fire protection which has been successfully applied to the Mandui forests, which is an undisguised copy of a system already inaugurated in the Panch-Mahals by that energetic Forest Officer Mr. W. A. Wallinger. As was to be expected, however, certain details of the Panch-Mahals scheme were unsuitable to Mandui, while

MANDUI TALUKA

Scale 1" = 2 miles



the different circumstances of the latter place made it necessary to introduce new rules inapplicable, perhaps, to the Panch-Mahals.

The forests of Mandui are situated in the north-east corner of the division and are 41,847 acres in extent. The ground is hilly, the highest elevation being 929 feet. The forests are chiefly mixed teak and *raiwal*,* but pure teak, as well as pure *raiwal*, is

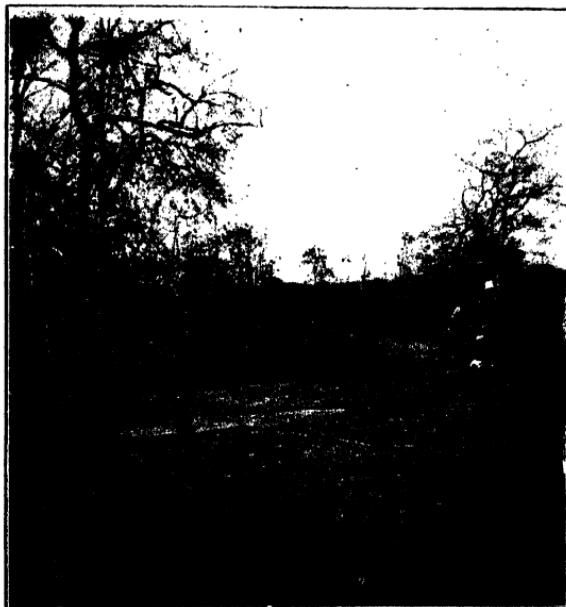


FIG. 1.—THE 30-FEET CUT LINE SEPARATING THE FOREST FROM VILLAGE LANDS.

found in some of the smaller western forests. Owing to drought the blanks, which support grass and reeds, have of late years become larger, and the forest, therefore, even more inflammable than formerly. Special measures, consequently, are a necessity.

The present system was started in the year 1898. In order to facilitate its description a map of the fire-lines, fire-stations, and drum-stations is given.

Early in October thousands of notices are posted up in the vernacular on trees at the entrance of roads or paths into the forest.

* *Raiwal* = everything except teak and bamboos.

These explain to the people exactly what acts, connected with fire, are prohibited by the Indian Forest Act and the rules thereunder, besides advising them to be on the safe side and not take fire-producing material into the forest at all. In addition, the subordinates are constantly warning the people in their villages, on the road and at bazaars, so that any one prosecuted pleading ignorance of the rules would be simply laughed at. Even contractors and their servants are made to sign a statement that they understand the rules in force. Notices too, showing the punishments inflicted for breach of rules, and which rules were infringed, are widely published.

The next measure is a very important one, *i.e.*, fire-tracing, mostly around the forest and along roads and foot-paths in the forest. This work has hitherto been started early in November, and finished, generally, by January 1st. Owing, however, to the people being all engaged in November in harvesting their crops the Collector has decided that fire-tracing in future is to be started on December 1st; but if sufficient people come on the work then it will still be possible to have the lines ready by January 1st. Many of the labourers are old hands, and consequently most of them are well acquainted with fire-tracing work. Guide lines are cut first on each side and cross lines every 100 yards. When dry the grass, &c., is burnt on a calm day. Accidents are comparatively rare. In December, as soon as the grass is dry and fires become a real danger, eight fire-stations on high hills are started. These eight stations collectively command a view of the whole of the Mandui forests. From Bilia Hill all the other seven stations and from each of the other stations two or more stations can be seen with a telescope. Two men, generally local inhabitants, are in charge of each station.

They build themselves a hut to live in and a platform up a tree to watch from. Very often their families accompany them. In the hut a large iron drum is kept. One man keeps a look out for fires during the day from the platform, while the other patrols the neighbouring fire-lines, sweeps up fallen leaves, burns them, and listens for the sound of the drum. Both fire guards live in



E. M. Hodgson, Photo.

The Kalmoi Fire Station, Surat Forests.

the hut at night. If a fire occurs, the man on watch in the station rolls out his drum and beats it. The fire guard patrolling the lines climbs a tree, ascertains from the smoke where the fire has occurred, hastens to the scene, and tries to find the offender and put out the fire. The beat guards at the nearest guards' houses who happen to hear the drum sounded beat their drums to assemble the villagers.

To insure the presence of at least one fire guard on each hill the following checks are in force. On Mondays, Wednesdays, and Saturdays, at any time of the day, a beat guard goes and hangs up a certain ticket in the hut, bringing down another, and hanging it up in the guards' house the same day. On any day, but especially on Tuesdays, Thursdays, and Fridays, the Divisional Forest Officer, Sub-Divisional Forest Officer, Ranger, Sub-Ranger, and Round Guard pay visits and make certain entries in a book sealed to a post in the hut. Surprise visits are paid at night, too, occasionally.

At sunrise a white flag is flown high above the platform ; at midday a red flag is placed under this : at sunset the white flag is removed. The Ranger has been supplied this season with a fairly powerful telescope with which he can check the flags on several, some times on all, the stations in one day.

By means of these fire stations and drums the following advantages accrue :—

- (i) There is a general unwillingness to fire the forest, owing to increased fear of detection.
- (ii) Fires are seen and signalled without delay.
- (iii) Help is procured at once.

Probably by far the most important advantage is the prevention of delay. A fire in Mandui given a start of a few hours may go on for days in spite of all human effort. If, however, men are quickly brought on the scene it is always possible to prevent much injury.

In addition to these measures the subordinates and villagers receive every encouragement and inducement to help the Department. Those who serve faithfully as fire guards for a season, and require permanent appointments, are given preference when

vacancies occur. The conduct of all subordinates is carefully watched and noted with a view to giving promotion to the more deserving. The villagers, especially in years of want, are allowed every reasonable concession. Patels who render ready assistance are rewarded annually with a turban worth about Rs. 4. These turbans are highly prized, and some of those who failed to earn a *puggree* the first year they were given out succeeded in doing so the following year. If the villagers turn out very quickly when the fire alarm is sounded they are allowed a small wage.

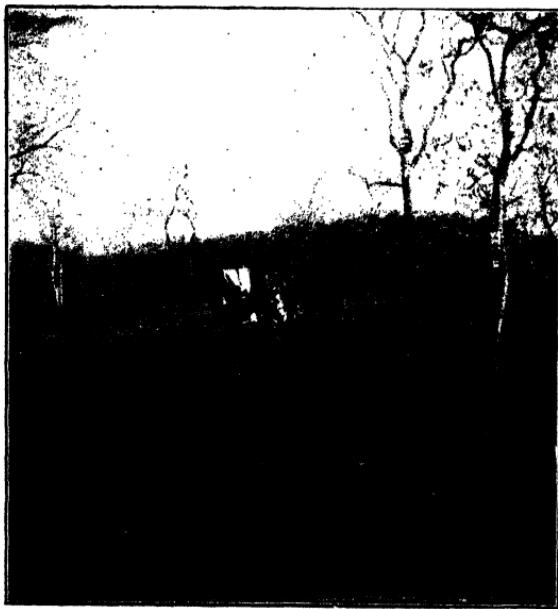


FIG. 2.—A 30-FEET CUT FIRE LINE SHOWING FIRE NOTICES ATTACHED TO A TREE AT ENTRANCE TO THE FOREST.

Inducements are given in the form of free-grants for cultivation and the right to cultivate a certain area, on payment, to a few persons called Forest Patels, in order to get them to live in *Ujed* or uninhabited villages, and help to protect the forest, more especially against fires. By the terms of the agreements these men have to relinquish their land, if called upon, within six months.



E. M. Hodgson, Photo.

The cut fire line between the forest and Karutha Inami village lands.

The following table is interesting, and shows the area burnt annually during the last eleven years, together with the cost of protection :—

YEAR.	Area attempted to be protected in acres.	Area burnt in acres.	Area actually protected in acres.	COST.
				Rs.
1894-95	41,846	16,374	25,472	1,314
1895-96	41,846	12,166	29,680	1,390
1896-97	41,846	4,100	37,746	1,233
1897-98	41,846	12,638	29,28	1,441
1898-99	41,846	7,766	34,080	1,332
1899-00	41,846	8,045	33,801	1,542
1900-01	41,846	1,964	39,882	2,286
1901-02	41,846	958	40,888	2,744
1902-03	41,846	2,541	39,305	2,841
1903-04	40,519	804	39,745	3,367
1904-05	40,519	Nil.	40,549	2,602

The cost varies somewhat according to the season. On an average, if arrangements are to be really effective, it will amount to Rs. 2,500 a year, or about 1 anna per acre.

Though the area burnt has, this season, been reduced to *nil*, the system is still capable of further improvement. Firstly, the cost of protection is rather high, even if the results appear satisfactory. This could be reduced by clearing the fire-lines of all trees and bushes. At present the outer 100-foot line, which separates the Mandui forests from the annual conflagrations in the neighbouring Baroda State forests, and a few of the others, mostly outer lines too, have been cut. But those on which trees are still growing become, quite early in the season, covered with fallen leaves, and need constant labour and expense to keep them clean and efficient. The time the beat guards and 16 fire guards can give to line-cleaning is not enough without the occasional help of extra coolies. It must be remembered, too, that cut lines, as can be seen in Mandui any way, are so much cleaner, and consequently more effective, than the present 100-foot inner lines could be reduced to 50 feet after being cut for the latter width. This matter rests with the Forest Department.

But there is one other point, and it is in the hands of Government. At present the forest villagers pay annas two per head for grazing for their cattle. If Government would be pleased to cancel this rule, and instead to allow absolutely free grazing in any forest village in which in the previous season there had been no fires, or on payment of Re. 1 per head if a fire had occurred, then, provided always the Forest Department does not relax its efforts, forest fires in Mandui would become a matter of past history.

Explanation of the illustrations.

Plate XVII—Shows the 100-foot cut line, over 20 miles long, separating British from Baroda State Forests. This line has never been crossed by fire.

Fig. 1—The 30-foot cut line separating the forest (high growth) from grass, bushes and scattered trees in Ambapur Inami village.

Fig. 2—The same fire line as No. 2 but showing notices hung up on a tree at the entrance of a road into forest. This road was also fire-traced, but as it had become covered with fallen leaves it would not appear different in a photo from the rest of the forest.

Plate XXXIX—Shows the Kalmoi Fire Station. The big drum is shown in the foreground in front of the hut.

Plate XL—Depicts the cut fire line between forest and Karutha Inami village.

THE FORMATION OF THE FOREST DEPARTMENT IN SIAM.

BY W. F. L. TOTTENHAM, O.U.S.E., I.F.S.

In 1895 the late Mr. Slade's services were lent to Siam to advise that Government on Forest matters, and the following is a short account of the very valuable services rendered by him to Siam in connection with the formation of the Forest Department in that country.

The greater part of 1896 was spent on tour, inspecting the more valuable forests, visiting the principal centres of the timber trade, enquiring into the systems of revenue collections, &c., &c., and a vast amount of information on all matters connected with Forestry in Siam was thus acquired.

On his return to Bangkok he submitted a report to the King in which were embodied certain proposals necessary for the better protection of the forests, among which was the formation of a Forest Department, which was at once sanctioned, and Mr. Slade appointed Chow-Krom. The services of several other trained officers were then obtained from the Government of India, and the training of Siamese lads at once commenced.

The principal trade being in teak, the areas producing that timber were first taken in hand, and Mr. Slade's Burma experience here proved of the greatest value. The greater part of the teak forests are situated in the Laos States (N. Siam) which border on the S. Shan States, Karennei and Indo-China.

Great trouble was experienced in getting the Laos Chiefs to relinquish all claims to hereditary ownership of the forests in their States, but Mr. Slade at last accomplished this, and the control of these forests was handed over to the Forest Department, each Chief receiving half of all royalties collected in the forests of his State instead of the whole, as hitherto. The issue by the Chiefs of irregular permits to work teak was prohibited, but as a very great concession, to avoid hardship, permits issued before a certain date were exchanged for leases ratified by His Majesty, and work thus legalised.

One of the first steps taken by Mr. Slade towards the introduction of systematic forestry into Siam was the drafting of a Forest Act. The difficulties attending legislation under extra-territoriality however proved insurmountable inasmuch as several years' constant work would have been required to pass that Act into law while there were in existence many very pressing abuses which required immediate suppression. Legislation was at last effected by the issue of a series of Royal Decrees, and by this very laborious means a somewhat poor substitute for a Forest Act was gradually built up.

One of the first of these decrees prohibited the girdling or felling of undersized teak trees, and thus an end was put to an enormous trade in poles and saplings which had not only endangered the future of a very considerable number of the most

valuable teak forests but threatened the extermination of teak over large areas.

Decrees were issued later (i) prohibiting the girdling or felling of teak except under a lease ratified by His Majesty ; (ii) dealing with the defacing of marks and supermarking ; (iii) regulating the use of private hammers ; (iv) prohibiting the removal of timber without property marks, &c., &c., and thus the most urgent measures for a proper protection of the forests and control of the workings were established.

In the meantime the old form of lease proving unsuitable and inadequate, a new form was drawn up under which the minimum girth at which trees could be girdled was considerably raised and provision made for the imposition of fines for destruction of timber, &c., &c. After innumerable lengthy negotiations Mr. Slade got the principal lessees to agree to exchange their leases under the old form to the new form, and their example was largely followed by the smaller lessees.

Mr. Slade having organised the various establishments of the Forest Department and split up the country into divisions, a systematic survey and examination of the forests was commenced in 1897-98, and by the end of 1900 sufficient data had been collected to allow of a decision as to the future policy to be adopted.

This examination confirmed what had been feared, namely, that the forests were being worked beyond their possibilities, and as leases fell in many large areas were in consequence closed and workings in areas which were reopened confined to the extraction of dead teak only, a condition of the renewed lease providing for girdling by a Forest Officer only if the possibilities of the forest were not being worked up to.

It must not be supposed however that Mr. Slade's attention was only confined to teak ; on the contrary, every effort was made to encourage the trade in "other woods," and considering the inadequacy of the establishment these efforts were attended with very considerable success.

The training of young Siamese lads in Forestry with a view to their ultimately being placed in responsible positions although

attended with very many disappointments was persevered in and took up much very valuable time.

The following figures amply suffice to prove that the collection of revenue had not been neglected and that the new systems introduced by Mr. Slade were successful :—

	REV. RS.	EXP. RS.	SURPLUS. RS.
1897-98	6,36,000	3,11,000	3,25,000
1900-01	13,88,000	3,81,000	10,07,000

To fully appreciate what this increase means, however, it must be remembered that more than half of the area of forests originally worked had been closed, the minimum girth raised, and a trade which produced a very considerable revenue crushed (*i.e.*, that in teak poles).

To effect the above in this very short space of time would under the most favourable circumstances be extremely creditable, but when the innumerable difficulties which beset Mr. Slade at every turn are taken into consideration it may be understood that it could only have been accomplished by the most extraordinary tact and perseverance as well as the devotion of his whole energies to what must so often have seemed not only an impossible but a thankless task.

That His Majesty to some extent appreciated his efforts may be gathered from the fact that he was graciously pleased to create him a Companion of the III class of the Order of the White Elephant of Siam, the highest honour he could confer.

CORRESPONDENCE.

FIRE PROTECTION AND OTHER MATTERS.

THE ORIGIN OF THE PURE TEAK FORESTS IN THE SURAT DISTRICT.

In the *Indian Forester* for May 1905, Mr. Gleadow expresses the opinion that fires, rab, grazing and the action of man account for the pure teak forests in the Surat District. I respectfully beg to differ, and believe, like Mr. C. M. Hodgson, that the forests of pure teak and grass in Surat are a natural formation. Everything in this Division points to these forests being governed by the soil, and not by the people, for the following reasons :—

The Dangs forests are overrun by fire not once but generally twice or three times in a season. The soil is deep, and natural regeneration, in spite of fires, good. Branches of teak as well as of *raiwal** are extensively cut for rab. Grazing is insignificant. Yet, in spite of fires and rab, there is no pure teak forest in the Dangs ; it is all mixed teak and *raiwal*.

In the Bulsar-Chikhli Range fires are very rare, rab not used at all, while grazing is moderate. Yet pure teak is found, but always on stony hills and never on the deeper and richer soil found on the lower ground, where the growth is invariably mixed teak and *raiwal* or pure *raiwal*. The only hills are Parnera, Kulsar-Udwada and Morai-Balitha-Chella, and these produce poor, stony soil, and are the only forests in this range that contain pure teak, naturally regenerated.

The Mandvi Range shows even still more conclusively that the growth is governed by the soil. Up to the year 1851 the records prove that the local inhabitants helped themselves to the produce of the forests just as they liked. The injury done to the teak by chopping and hacking is evident in every forest, and proves that the villagers made no nice distinctions between Royal and non-Royal trees, but did what was, under the circumstances to be expected—took exactly what they wanted. Rab is never

* *Raiwal* = every thing except teak and bamboos.

used in Mandui, and fires have injured pure teak, pure *raiwal* and mixed teak and *raiwal* alike. Grazing is not excessive. The main mass of the forest is mixed teak and *raiwal*, but some of the western reserves, where the population is much denser, contain pure teak, others pure *raiwal*. The pure teak forests are *invariably* found on stony hills, the pure *raiwal* always on low-lying ground where the soil is deeper and richer. The largest of the pure *raiwal* forests is found in the Usked, Tadkeshwar, Togapur, Mujlao and Dharampur villages on low-lying or slightly undulating ground. The soil is rich enough in some places for field crops. But in Dharampur there is one small hill with poor, shallow stony soil where teak replaces *raiwal*. These forests are all near the town of Tadkeshwar, and are more pillaged than any other forest in the Mandui Range. Yet, with the single exception of the small hill in Dharampur, where the poor soil is perhaps less unfavourable to teak than to *raiwal*, *pure raiwal*, and not pure teak, is found. I do not need to look far for further examples, of which there are many, but will merely mention the following cases in which pure teak and pure *raiwal* alternate quickly as the soil changes and in or close to the same village. Thus the low, stony hills in Titoi and Kalibel produce almost pure teak. Mixed teak and *raiwal* are found on the better soils on the lower ground in the latter village. The rocky hills of Kimdungra produce nearly pure teak, whereas the rich soils of Ladkua and Dadakui, close by, support a growth of practically pure *raiwal*. There is not a single instance in this Division of pure teak on good, flat land, or of pure *raiwal* on the rocky hills with a miserable, brown, stony soil.

I think I have written sufficient to show that the dominant factor in settling the composition of the forest growth is soil, and not man.

E. M. HODGSON.

THE PROPORTION OF STAFF TO REVENUE IN INDIA.

In your April number statistics of the forest area in Burma were given to prove the inadequacy of the Forest staff.

I enclose a statement prepared on returns which are now two years old but which is still interesting as showing a direct connection between the strength of the staff and the revenue realised in the various Provinces.

F. A. L.

Province.	Reserved Forest, square miles	Protected Forest, square miles.	NO. OF Conservat- ors.	SQUARE MILES PER		Revenue per square mile.	REMARKS.
				Imperial officers,	Conservator, Imperial officer.		
Bengal ...	5,964	3,582	— 1	17	9,702	571	133
Andamans ...	156	...	— 1				
Assam ...	3,707	...	1	9	3,707	412	138
United Provin- ces.	4,053	30	4	16	1,056	264	408
Ajmere ...	139	...					Includes School Circle.
Punjab ...	2,314	4,888	1				
Baluchistan ...	203	...			7,405		
C. Provinces...	18,778	...	3	36		837	101
Berar ...	3,954	...			11,366		
Burma ...	18,606	...	4	50	4,652	372	316
Madras ...	17,154	2,412*	3	33	6,522	593	130
Bombay ...	13,924	791	3	26	4,905	566	162

THE MADRAS FOREST MEMBER'S TOUR IN ANANTAPUR.

I do not know if the "printer's devil" is responsible for several inaccuracies in my letter published in the May issue, but I would request to be allowed to point out that I did not write that the surplus from grazing in this district had been from one-half to two-thirds of a lakh.* Not only does the revenue from this source

* Unfortunately it is impossible to keep old MSS. They are destroyed as soon as the number has appeared. It is difficult, however, to believe that any printer's devil could be responsible for such a wide deviation from the original sentence as this implies.—HON. ED.

not reach half the smaller of these figures, but also it is practically impossible to say what the expense is, since no special establishment is maintained for this purpose. I said that the surplus under all heads had been from half to two-thirds of a lakh of rupees—which is a very different thing, and which is a figure that, I consider, gives a very unreal view of the needs of the district. A paragraph on page 245 in the present issue (May) in the article headed "Forest Administration and Revenue-making" is in my opinion very *à propos* of this district. I also said that the expenditure incurred on fencing would show to the ryot that the Forest Department was trying "to justify its existence." Whether by fencing it is grappling with this question in an enlightened manner, was not a subject raised by me. From the ryot's point of view there has only been seen a considerable revenue raised and no attempt made to grapple with the reply always given to them "If we do not reserve the hill it will very soon be absolutely bare."

11th June, 1905.

B. H. BARLOW POOLE.

REVIEWS AND TRANSLATIONS.

PROGRESS REPORT ON THE FOREST ADMINISTRATION IN THE PUNJAB FOR 1903-04.

Even with six million acres of forest land still on its books the Punjab Forest Department cannot view the steady shrinkage of the area under its control without misgivings. Nearly 130,000 acres were alienated during 1903-04 largely for colonisation purposes, and at present there are no indications as to where this is going to end. Irrigated colonies are no doubt a good investment, but the effect of the total destruction of forests in their vicinity cannot be adequately appraised in currency; the supply of timber for agricultural implements and house-building, of firewood, and the provision of grazing grounds for the large number of camels in the districts of Montgomery

Shahpur, and Multan, which are the districts chiefly affected, are problems which the extinction of forest growth brings prominently to the front. The establishment of cotton-ginning mills, too, will produce a steady and extensive demand for firewood which cannot be met. The problem has been partly solved by proposals to form irrigated plantations on the model of Changa Manga, and it is gratifying to note that ten years hence the Punjab Forest Department is likely to have an additional 30,000 acres of irrigated plantations under its control. The adequacy or inadequacy of this provision must be left to the future to decide.

As regards Working Plans, the Punjab must be considered well advanced, and beyond periodical revisions very little work in this branch remains to be done.

The Local Government in its review noticed with regret the small expenditure on roads and buildings during the year, and the remark is more than justified by the facts. With a gross revenue of 16½ lakhs of rupees an expenditure of a little over Rs. 23,000 on communications and buildings cannot be termed liberal, representing as it does rather under Rs. 2,000 average for each division, and, in all, only 1½ per cent on the gross revenue. As the Local Government pertinently observed "the provision of such communications and accommodation is a sound investment;" and anyone acquainted with the forests of the United Provinces can bear this out.

Forest crime showed a tendency to steady increase, especially in compounded cases, the figures for such cases being 3,273 compared with the past triennial average of 2,719. It is worthy of note that of the total number of cases compounded no less than 2,516 relate to two divisions, Kangra and Rawalpindi, though the circle consists of twelve divisions in all. These figures are striking; the increase may be due to increased vigilance on the part of Forest subordinates, but it is more probable that these districts are over populated; that their whole being depends on the Forests around; that in the opinion of the people it is preferable to offend, and even be caught in the offence, rather

than attempt to do without the produce they require. If this is the case, the restrictions of the Forest Department would appear to be too severe and to press too hardly upon the people, and in consequence some modification of existing conditions seems to be called for.

Year by year the demand for forest produce increases at a very rapid rate; during 1903-04 nearly four and a half million cubic feet of timber was removed by various agencies—an increase of well over a million cubic feet on the figures of the preceding year. It is satisfactory to read that departmental operations for extracting timber are gradually being given up in favour of removals by purchasers. Taking the undermanned state of the department into consideration, and also the increasing bulk and complexity of forest work in the Punjab, this change of policy is justifiable. It has its disadvantages, but provided the control is good and no long-term contracts are given, neither the forests nor the revenue should suffer; and, further, the most important object of all is partly attained, namely, the freeing of the Forest Officer of some of that ever-growing mass of accounts and office routine, thus leaving him more time for his legitimate work—the study and application of sylviculture and the improvement of his forest estates.

The Kangra resin industry, by showing a profit of nearly Rs. 22,000 on the year's working, has fully established the financial soundness of the undertaking, and the Forest Department having accomplished this is now trying to transfer the manufacture to private enterprise. The financial results of the year are not the least striking proof of the year's progress; with a gross revenue of $16\frac{1}{2}$ lakhs of rupees and a net profit of nearly 7 lakhs no one will grudge the Conservator and his officers the Lieutenant-Governor's congratulations on a successful year's work.

But the burden of administration is rapidly approaching that point when it will be no longer bearable by the present staff. With its twelve divisions, a forest area largely in excess of that in the United Province, and a gross and net revenue nearly

equalling those of the above province, the Punjab will soon have to face the problem of partition in its forest administration. That such partition will result in increased efficiency and increased revenue, few, who know the province, can doubt.

THE CANADIAN FORESTRY JOURNAL.

In the *Canadian Forestry Journal* we welcome most heartily the appearance of a new Forestry periodical in the Empire. This monthly magazine is the outcome of a resolution passed at the fifth annual meeting of the Canadian Forestry Association, at which it was decided to found a periodical Journal to be devoted to the interests of the Association.

We have read the first number with interest and pleasure, and gather that the objects of the Journal are to educate public opinion, to take an intelligent interest in the preservation and conservation of the forests of the country, to prevent further waste by heavy overcutting and wasteful fires, and to encourage planting-up operations.

But whilst this would appear to be one of the objects of the Journal, it has another side—the professional one, and its scope and development in this direction will be eagerly watched by its contemporaries. The first article written by the Editor, Mr. R. H. Campbell, describes the reasons for the formation of the Canadian Forestry Association and explains how the objects of the Association are to preserve to Canada that vast wealth of forest which still remains to her in spite of the great devastation already committed in her forests.

Other articles deal with Canada as a Field for Intelligent Forestry, Forest Influences, A Glance at the Forest Conditions in New Brunswick and Forest Resources of the Labrador Peninsula. Some notes and reviews wind up the number. Altogether the Journal is a bright little periodical of some 50 pages and is illustrated throughout. We can confidently recommend it to all those who wish to keep themselves *au fait* with the progress of Forestry in the Empire.

SHIKAR, TRAVEL, AND NATURAL HISTORY NOTES.

A HOLIDAY IN CALIFORNIA, &c.—LETTERS FROM T2.

(Continued from page 346.)

In the middle of December we travelled from San Francisco to Victoria by sea. The passage was wet and blustering. After San Francisco, with its typically American and, to use the latest word, "strenuous" life, Victoria is a very great contrast. It is very English, and the climate is English too. We spent a month at Duncan's, on the island of Vancouver, about forty miles north of Victoria, and nearly every day it was wet, misty and slushy. This was a great change from my experience only a month previous in the Colorado desert, when we slept out under the stars and there was no dew even. It is amusing to note how in each place the "gup" centres on one item. In the desert now being reclaimed the talk was all of "water."

In Central California it was all "raisins" and their prices; a cent more or a cent less per pound makes all the difference.

Here in British Columbia it was all a question of "stumps." Nearly everyone's idea was to clear away the nasty forest and make fields instead. And the chief difficulty lies in getting stumps out of the ground.

Scattered about the different farms round Duncan's, there are quite a number of young Englishmen learning to farm. These "Griffins," as we would call them in India, go by the expressive name of "Mudpups." About ten miles up the Railway north of Duncan's at Chemainus, I visited a saw mill said to be one of the largest in the world, capable of turning out 200,000 feet every day, or say the outturn of some 200 average logs. Having two band saws this would be 100 logs for each; the speed at which the two steel carriages or saw benches carry the log backwards and forwards is certainly a revelation to one familiar only with the usual Burmese circular saw work. The woods being cut, Douglas

fir and spruce, might almost have been so much cheese. The logs of course were hauled up out of the water on an endless chain armed with teeth and then travelled along on rollers. A couple of huge teeth then shot up from below and pushed the log on to other moving rollers to either the right or left saw log carriages. Here a regular "Devil Hand" with steel finger bars and a jointed thumb would shoot up from under the floor, grip the log and place it in the best way for conversion. This "Devil Hand" alone does the work of at least half a dozen men and much quicker too. One machine for sawing planks and square edging had no less than 40 small vertical fixed band saws.

This saw mill is on an inlet of the sea. Sailing ships can come up right alongside the mill. At the time of my visit, there were two, one for the United Kingdom and the other for South Africa. Saw dust and refuse is not allowed in the water. The furnaces, seven in all, are mostly fed with saw dust. This is often done automatically from above by endless chain conveyors. Chips from the different planing machines are caught by strong air suction funnels placed above each machine. Refuse not consumed in the furnaces is all burnt in a special "incinerator." This is boarded up high all round and the boarding all kept wet. The refuse is brought up to a height by endless conveyors and then shot over on to the burning pile. This is on a gridiron, and to prevent it being choked up with cinders, the latter are all carried away by a stream of water below on to a sieve outside. The ash and charcoal is here shovelled up alongside, and the bay water thus suffers no pollution.

The timber being practically all cut green, there is a big building into which trucks of planks can be run in on rails and dried by steam pipes.

Labour in this mill consisted of white men for the most skilled jobs, Japanese for less important places, and Chinese for ordinary coolie work.

Near Duncan's I saw a small country mill. The chief point of interest lay in the logs being sawn by circular saws and, where very big, by another circular saw above simultaneously. These saws

also were different from the usual Burmese kind in that the teeth were inserted, and when worn out could be replaced by new ones.

At Vancouver also I went over the biggest mill. The actual working in the forest is practically at a standstill during the winter. In California, however, near Santa Cruz, and again near the Yosemite, I saw some interesting points. Slide ways are made down the hill side by placing two smaller tree logs alongside each other. The good timber is slid down these to the main slides and down the latter to bigger roads. Along these last and more level places the logs are hauled along by a cable operated from a donkey engine. Such a cable may be as much as two miles long. The big mills at Chemainus and Yosemite had further regular railway lines to bring the logs in. The Yosemite mill up in the hills takes its sawn planks down to the plains by floating them down a water flume some fifty miles long.

From Victoria we went by the C. P. R. to Banff. One of the most striking features is the extent and massive size of the snowsheds as a protection against avalanches. The country in British Columbia, 20 miles on each side of the C. P. R. line, is under the Dominion Government. The forestry branch under the Minister for the Interior does now seriously attempt to keep fire out of this 40-mile wide strip. This should greatly improve the forest, which has been very badly burnt in the past. In time the new growth or "second-growth," as it is often here called, should be a great protection against avalanches, and so save a large expenditure on snowsheds.

At Banff we had the pleasure of swimming in a beautiful blue and yellow hot sulphur pool in the open air with snow all around and air temperature at zero. Winnipeg at our visit was cold even for the natives, temperature 30°. That with the usual cutting wind made one quite catch one's breath. Even the policemen sported huge official furcoats and the horses' noses were one solid lump of ice. At Montreal we spent a month with a nice steady cold fine weather varying from zero to 20° F. So dry and bracing that after sliding your feet across the room your finger

could draw a spark from another person's nose ; or if you touched metal, particularly copper, you got quite a shock. Brushing one's hair too was quite a trouble, since it would fly up again to the brush.

In Burma men are now "enjoying" the hot weather. Here, St. Patrick's Day in Quebec, the snow is just beginning to melt in the midday sun.

EXTRACTS FROM OFFICIAL PAPERS.

THE PROMOTION OF ROADSIDE ARBORICULTURE.

We have already drawn attention in these pages to the great importance of planting avenues along the roads in this country and to the apathy and neglect which this work meets with in many districts. Until within quite recent years the great operations of the earlier administrations which gave to the main arteries of the country and most of the smaller ones the fine avenues now in existence had, doubtless in some measure due to the increased facilities of travel following the introduction of railways, fallen into almost complete abeyance. Blanks in the great avenues due to the overthrowing of trees during severe tropical storms or to their natural decay were not filled up, and the planting up of the many new lines of communication opened out was entirely neglected.

We last year alluded to the fact that the Government of India had addressed Local Governments on this matter. A Resolution has now been issued by the Department of Revenue and Agriculture dealing with measures for the promotion of roadside arboriculture. We welcome it alike for the far-sighted statesman-like policy it gives evidence of and for the incalculable benefits to posterity it is likely to result in.

The Resolution commences by stating that the Government of India, having had under consideration the subject of the maintenance of avenues of trees along roadsides in India, communicated to the Local Governments and Administrations in March 1904 some observations which may be repeated here. The question,

they said, is one of real importance, because of the welcome shade afforded thereby to wayfarers, the substantial addition to the beauties of the landscape, and the mitigation of the discomforts of long journeys by road. The practice of planting avenues of this description was in earlier days as much a feature of British administration as the construction of the roads themselves, and some of the older avenues on the main roads of India still supply the most agreeable of memorials to the taste and provision of their founders. The practice has nowhere died out, and it is still fairly widely though intermittently and unmethodically, pursued. In recent years, however, great havoc has been caused in some tracts by the mutilation and cutting down of timber in times of famine, and observation tends to show that these ravages have been only partially repaired. In other parts of the country the importance of the matter appears to have been imperfectly kept in view, and from want of a sustained policy, money and effort have been wasted ; and in many places avenues, formerly in existence, have been allowed to disappear or to become disfigured by unsightly blanks.

The Government of India have now ascertained from the Local Governments the arrangements at present in force in various provinces for the maintenance of roadside avenues. The opportunity is, therefore, taken to present a brief review of those systems now under contemplation.

In Madras all expenditure is from the local funds. The total length of roads in charge of the local boards is 27,619 miles, of which 16,566 have been provided with avenues, the total number of trees being three millions. During the past ten years 177 miles of avenue were planted, the annual expenditure being Rs. 96,000 and the income Rs. 117,000.

In Bombay no detailed statistics are available, but as a rule on the existing provincial roads good avenues exist where the ground is suitable. The want of funds checks the extension of tree-planting.

In the Central Provinces and Berar 3,000 miles are still devoid of trees, out of 4,200 miles. The Public Works expenditure

on avenues is to be gradually raised from Rs. 46,000 to Rs. 90,000 annually, while the District Councils are to spend Rs. 25,000.

In Bengal 2,600 miles have been planted during the past ten years by the District Engineering staffs. The average expenditure is Rs. 52,973 and the average income only Rs. 13,395. A comprehensive programme is to be drawn up on the lines adopted in the Central Provinces, and the Local Governments will decide the minimum expenditure by each District Board.

In the United Provinces during the last ten years about 1,300 miles have been added to the length planted, which now amounts to some 8,000 miles ; but there are still some 20,000 miles of road of all kinds without avenues. The average expenditure was Rs. 81,000, and the average income Rs. 77,000, so that the net expenditure averaged only Rs. 4,000 per annum for the ten years ; and for the last five years there was actually an average surplus of Rs. 6,000. Working plans have been prepared for most districts. Arrangements are being made to appoint and train supervisors, and a new manual of arboriculture is ready for issue.*

In the Punjab the length of roads suitable for avenues, apart from those managed by the Canal Department, is 15,000 miles, of which 8,000 miles are fully planted. During the last ten years the addition made to the length of avenue has been 1,200 miles. The average annual expenditure has been Rs. 2,63,000 and the average income Rs. 1,98,000 (but these figures include the results for groves and plantations as well as avenues). For canal roads, the corresponding figures are : Total length of road or canal, 8,000 miles ; planted, 4,100 miles ; average expenditure, Rs. 1,07,000 ; average income, Rs. 85,000. The Province has a useful manual of arboriculture, and detailed instructions have recently been issued for systematising operations for the preparation of working plans with maps, and for the training of supervisors.

In the North-West Frontier Province good progress has been made, the annual expenditure being Rs. 42,000 and the income Rs. 9,000. The Chief Commissioner hopes to increase the

* This will be reviewed in the September number.—HON. ED.

expenditure and to provide training for the staff, together with working plans.

In Baluchistan, owing to the arid climate and indifference of the people, small progress is reported. The revenue assigners and persons in receipt of allowances are being called upon to plant trees, while honours and rewards are to be granted to those who distinguish themselves in this useful work.

In Ajmer-Merwara an improved system was introduced a few years ago with encouraging results.

The Government of India, in reviewing these reports, says that the first, and in some respects gravest, difficulty in arranging for the extension of operations is the provision of funds. It is suggested that the net and not gross expenditure should be looked at, and that it is material to observe that the grant recently made to District Boards from general revenues will enable them to make better provision for all these duties, including arboriculture. Various useful suggestions are then made as to the preparation of working plans, the planting of trees, supervision, etc. The Resolution contains the following paragraph :—

"It is essential that as far as possible the sympathies of the neighbouring population should be enlisted in the preservation of the roadside trees. In the case of fruit trees, the produce of which is of little value, cultivators of adjoining fields should be allowed to take the fruit on the condition that they protect the trees from serious damage ; and when a fodder famine is prevalent judicious arrangements should be made to utilise the edible leaves of trees along the roadsides as fodder for cattle at reasonably cheap rates. This does not mean that the trees themselves should be heedlessly mutilated or cut down, but that the temporary sacrifice of sylvan amenity may be gladly accepted in the interest of saving valuable animal life. The practice of lopping or otherwise injuring a beautiful avenue when preparations are made for the reception of a high Government official is particularly deprecated. As regards investigating the progress made in roadside arboriculture, the Government of India are content to leave the Local Administrations to prescribe such arrangements as they think best."

The Resolution concludes :—

"The Governor-General in Council believes that if regard is paid to the suggestions above put forward, and if due advantage is taken of the recent additions made to the resources of District Boards, the planting and maintenance of roadside avenues in this country will be placed on a far more satisfactory and systematic footing than heretofore. He trusts that in consequence of the renewed attention which may now be expected to be devoted to the subject the ravages caused by neglect and famine will be gradually but surely repaired, and that the advantages, which the present generation has reaped from the energy and foresight of its predecessors, will be continued in even fuller measure to posterity."

MISCELLANEA.

THE TEAK TRADE AND FOREST CONSERVATION IN SIAM.

It has been thought advisable by the Forest Department to make a statement in reference to the criticism contained in the report of Mr. Beckett, H. B. M. Consul for Chiengmai District, for 1902. That report seems to be based on the assumption that because in 1897 a certain amount of timber was being extracted annually, this amount is therefore the annual outturn of Siam which must not be diminished or the interests of British subjects will suffer. This view ignores the fact that a teak forest must not be regarded as a source of production where the yield is proportional to the labour expended, and that it takes about 150 years for a teak tree to arrive at maturity.

The maximum material that a forest can produce is called its "possibility;" if the possibility of a forest is exceeded the forest tends to diminish in value, and at last arrives at a stage when further felling is impossible and the area must be absolutely closed for a period that may extend to 70, 80 or 100 years. A teak forest is not like a field where in cases of impoverished soil a few cart loads of manure will repair damages.

Mr. Slade as early as 1897 gave it as his opinion that the possibility of the forests was then being greatly exceeded, and that unless fellings were reduced the existence of the forests would be jeopardised. Since it was started the Forest Department has consistently endeavoured to reduce the outturn to reasonable limits. Yet what do we find? The number of logs passing Paknunpoh during the three years 1897-99 averaged roughly 56,000 logs, for the next three years 83,000 logs, and for 1903 no less than 108,530 logs were measured for duty. The average for the seven years 1897-1903 was over 75,000 logs a year, whilst the possibility of the Menam Valley is probably well under 30,000 logs. In 1897 the scramble for timber had just commenced, every available tree was being girdled and thousands of immature teak trees in the form of house posts were being extracted. The then Conservator, Mr. Slade, did his utmost to stop this abuse which, though not forbidden under the existing leases, was never anticipated when the leases were issued. Then began the negotiations for the exchange of leases in the old form for similar leases in the new form; in the latter many vexatious clauses were abolished and the leases were made far more workable. As a set-off to this the right of girdling was taken away. The exchange of leases took many weary months to negotiate, and in the meantime girdling was going on everywhere with redoubled vigour, until in some of the smaller leased areas hardly a sapling was left. Mr. Slade, therefore, gave out that further girdling during negotiations for the exchange of leases would be considered full justification for refusing to renew the leases when they fell in. This had some effect, and the furious girdling that had been going on was diminished, but by no means stopped. In some of the small forests mostly worked by Neos girdling had to stop, for there was nothing left to girdle.

The Borneo Co., Ltd., acting up to their declared policy of supporting the Government in every way, stopped all girdling, but another firm within three or four months claimed to have girdled 180,000 trees, of which nearly 60 per cent were reported to be undersized, i.e., of a size that would never have been allowed to be girdled in

any forest under proper management. Mr. Beckett writes : " though British firms had the power to girdle under their former leases, they generally refrained from doing so during the last two years of the lease in deference to the wishes of the Conservator of Forests." This statement has been made before, and is a mistake ; they stopped girdling because they were ordered to, and it is in consequence of their having obeyed the orders that they hold their present leases, which, as explained above, would not have been renewed unless they had obeyed the order.

Mr. Beckett's criticism upon the Forest Administration may be divided into three heads—

- (I) Insufficient supplies of girdled timber ;
- (II) The unsatisfactory system under which new girdlings are now provided ; and
- (III) The closing of areas, hitherto scarcely worked, on which there are many thousands of excellent old girdled trees ready for felling.

Under the first head the Department is in no way to blame. It is well known that half the former areas were given to each lessee for six years with a promise that under ordinary circumstances a lease of the remaining half should be granted on its expiry for a further six years. Twelve years' uninterrupted work was therefore guaranteed. It was estimated that (with few exceptions) the trees already girdled were far in excess of the possibility for twelve years, and that at the termination of this period, even if no trees were girdled, a large proportion of the forests would have to be closed for long periods to enable them to recoup. It was not intended that any further girdling should be done on these half areas except in a few cases which will be dealt with later.

The lessees were, therefore, in a position to count themselves the girdled trees standing in their leased areas, and by dividing this by, say, 10 (for during the last year of the lease of each half area their energies would naturally be devoted to extracting all heaped logs) they could ascertain the exact number of trees to be felled each year and they could arrange their staff, number of elephants,

etc., accordingly. The outturn would have been maintained at a normal figure and twelve years of sustained work would have given the Forest Department time to frame working plans for the whole of the forests. Until a working plan has been framed for a forest, any Forest Officer worthy of the name must provide a margin of safety and allow the extraction of less than he considers the possibility of the forest. The working plans officer by actual countings on the ground and by studying the rate of growth on the area, etc., is able to fix the possibility of the forest which under no circumstances can be exceeded without damaging the forest. The few exceptions which were referred to above are the few large forest areas in parts of which no work had ever been done; in these there was still virgin teak forest in which girdlings could be carried out with advantage to the forest and the revenue. The main object, then, of the half area leases was to reduce the annual outturn to one-tenth of the actual number of girdled trees and to give lessees an opportunity of disposing of their establishments to the best advantage. Has this been done? and if not, is it the fault of the Forest Department? It has not been done; firms have generally arranged to fell in the first half area almost the total number of girdled trees available for six years' work within the first two years of the lease; then, that their work may not come to a standstill, they demand fresh girdlings and protest against not being allowed to fell the girdled trees in the second half areas that are being retained to provide them with work during the second period of six years.

They continually use the argument of damage by fire to standing girdled trees, loss of interest on revenue, etc., etc. They may rest assured that these have not been lost sight of by the Forest Department and they are infinitely preferred to the remedy suggested, *viz.*, the immediate felling of all girdled trees, the enforced girdling of sufficient trees to maintain an outturn based not on the possibility of the forests but on the aspirations of the timber firms, the speedy ruin of the whole forest area and the reduction of forest revenue to practically nothing.

But the Forest Department in its endeavours not to cause injury to any one, even though the forests may suffer, have consented to girdle two out of five marketable trees where such can be found. This is a concession to trade which is of questionable soundness from a sylvicultural point of view, and should be considered a very great concession indeed, imperilling the future of the Siamese administration and the maintenance of the yield.

This brings us to Mr. Beckett's second point - Unsatisfactory system under which new girdlings are provided. Past experience in Burma and recent experience in Siam having shown the absolute fallacy of permitting *wholesale* girdling by lessees, even where this permission has been hedged round with rules and regulations, the alternatives were either to do the girdling departmentally or to permit the lessee to do it under certain restrictions and proper supervision.

When the question of girdling in the renewed leases first arose the writer understood that there would be an increase of seven Europeans in the establishment, and on that understanding guaranteed to arrange for all girdlings to be carried out departmentally. Difficulties arose, however, in obtaining men, and as the existing staff was not even sufficient for the ordinary divisional work of revenue, detection, survey, etc., etc., other arrangements had to be made. The following procedure therefore has been adopted throughout. On receipt of an application from a lessee for girdling, when possible, estimates of green marketable and dead trees have first been made by a Forest Officer, the average annual outturn ascertained, and the stock of logs lying in the forest taken. The balance of trees required to be girdled to keep up a reasonable outturn was then fixed. Girdling having been thus proved absolutely necessary, sanction was obtained from H. R. H. the Minister of the Interior. When Forest Officers have been available the girdling has been done by them with no limit but that necessitated by the number of trees required to keep up the outturn and taking into consideration the possibility of the forest and sylvicultural requirements. When no Forest

Officer has been available the lessee has been permitted to girdle up to a certain limit by approved European assistants of the lessee.

This girdling is then inspected by a Forest Officer, and if no breaches of the rules regulating girdling have been detected, girdling up to a further limit is allowed, and so on till the number of trees required or the possibility of the forest is reached. This is the system under which trees are girdled, and it must not be forgotten that such girdlings were never contemplated when the half areas were first leased. The Forest Officers instead of framing working plans for the forests are occupied in girdling timber, and if this is to continue the staff must be greatly increased. Mr. Beckett writes : "The Forest Department should now after seven years' work be in a position to state with tolerable accuracy the total number of marketable trees now standing in the Menam and Salween basins." Has Mr. Beckett any idea of what this means ? To acquire the information means working plans for the whole of the forests of Siam. Does he know that after 50 years in Lower Burma working plans are not yet complete, and that after nearly 20 years in Upper Burma the area under working plans is but a tiny fraction of the whole area ? And if this is the progress in Burma with its comparatively huge staff, what length of time will elapse before the forests of Siam can be seriously dealt with by a staff that is almost microscopic ?

Mr. Beckett then proceeds to make what he calls a fairly accurate forecast of future outturns based on what he considers six typical forests of Northern Siam. Unfortunately the forests in question were by no means typical but were selected by the Forest Department on the representations of the lessees that they contained the greatest quantity of marketable timber, and as most of the Forest Officers were inexperienced in girdling operations on scientific principles it was considered advisable to commence in forests where the stocks were sufficiently large to minimise chances of damage being done, through ignorance, by those operations.

But let us examine Mr. Beckett's figures a little more closely and apply them to ascertaining roughly on what scale girdlings

could be allowed. There are said to be 22,000 girdled trees and the following growing stock :—

Over 6' 4"	...	...	17,000
4' 6"—6' 4"	...	...	18,000
Under 4'	...	...	54,000

A tree of 6' 4" has not attained its maximum marketable value and the lowest limit of girth for girdling should be 7'. It is impossible to say accurately what proportion of the 17,000 trees there are between 6' 4" and 7', but let us arbitrarily assume 2,000. Then the number of so-called I Class trees, 7' and over in girth, is 15,000 and the number of II Class (*i.e.*, 4' 6" to 6' 11" in girth) is 20,000. It is necessary to divide the 54,000 trees into two classes, *viz.*, 3'—4' 6" and under 3'. This again must be an arbitrary division; let us assume 24,000 are III Class and 30,000 IV Class :—

Then our stock stands at I Class 15,000 trees.

II	"	20,000	"
III	"	24,000	"
IV	"	30,000	"

Now in an ordinary forest it takes 60 years for a tree to grow to 3' girth.

"	"	"	30	"	"	from 3' to 4' 6"	"
"	"	"	40	"	"	" 4' 6" to 6'	"
"	"	"	30	"	"	" 6' to 7'	"

Further, it is usual to allow that the following percentages of the different classes will survive to reach maturity :—

95% of the I Class

85% " II "

70% " III "

30% " IV " dominant and suppressed. We have now some rough data to go on. The "revolution," *i.e.*, the period which must elapse before the IV Class trees reach maturity, must be 160 years, and the total stock available during that period will be—

95% of 15,000	14,250
85% " 20,000	17,000
70% " 24,000	16,800
30% " 30,000	9,000
	—————
	57,050

This will allow 356 trees a year to be girdled, but as the areas are so large a proportion of these are bound to be solitary trees which cannot be girdled, and 300 would probably be an outside limit.

If this is the condition of the six finest selected forests in Siam, that of the others must indeed be bad. Were a working plan for these six forests to be framed, the prescriptions would probably be to allow no girdling at all for the first "sub-period" of 32 years and to distribute the 22,000 girdled trees amongst these years. The outturn would then be about 700 trees a year for 32 years after which the girdlings of 300 trees mentioned above might be increased to 400 trees a year. Assuming Mr. Beckett's figures to be correct, in 1902 there were 11,000 girdled trees, and the number of trees available for girdling during the period of 160 years would be 67,500 ($57,050 \times 95/100$ of 11,000) and the possibility of the forests would be 422 trees per annum. But in 1902 no less than 11,000 trees were girdled, or 26 years' supply, and the possibility of the forests was thereby reduced from 422 to 356 trees per annum. To restore the forest to its original state 58 years of absolute rest are therefore required. And yet Mr. Beckett writes "There is thus a deficit of 20,000 trees" (*i.e.*, to be girdled within the next six years) "if work is to be continuous."

These are six selected forests, and to follow out Mr. Beckett's views will mean girdling during the six years the whole of the I Class trees as well as 3,000 immature trees under 6' 4". These will be extracted in six years, and then the forests will have to be closed for an indefinite period, and the traders will have to find pastures new.

MYITKYINA,
NORTH BURMA.

W. F. L. TOTTENHAM,
In the *Siam Observer*.

**REPORT ON THE WORKING OF THE CASUARINA
PLANTATIONS IN THE NELLORE DISTRICT
SINCE 1899-1900.***

BY E. R. MURRAY, DISTRICT FOREST OFFICER, NELLORE.

The accompanying statement shows the blocks which have been worked since the introduction of the working plan in the year 1899-1900:—

Year.	NUMBER OF COM- PARTMENT WORKED.				Revenue realised		Expenditure incurred.		Net profit. R. a. p.	Net profit per ton.	Net profit per acre.	REMARKS.	
	Dugarazpatnam.	Kottapatnam.	Tamminipatnam.	Varini.	Quantity of wood brought to depot when departmental operations were carried on.	T. w.	R. a. p.	R. a. p.	R. a. p.				
1899-1900 ..	5	3	4	3	7,858	05	44,507	0	11,985	0	32,522	4 2 2	81 0 0
1900-1901 ..	3	4	6	2	4,173	35	17,817	0	6,747	0	11,070	1 8 6	84 8 0
1901-1902 ..	4	8	5	4	2,105	15	9,526	12	6	2,295	13	7 3 0	77 2 6
1902-1903 ..	1	0	1	1	...		20,467	0	0	940	0	20,227	2 9 5
1903-1904 ..	2	2	10	10	...		31,775	0	0	495	0	31,280	...
1904-1905 ...	7	7	7	9	...		38,000	0	0	...		...	...

2. In the opening year of the operations, all four blocks, aggregating in area 397 acres, were worked departmentally, 7,858 tons of wood having been trammed to the various depots on the canal. This wood when sold realised Rs. 44,507, and as the

*Department of Land Revenue, Madras, Forest Branch. No. 2. Superintendent, Government Press, Madras, 1905.

expenditure on working it out was Rs. 11,985, exclusive of establishment charges and cost of laying the tram lines, etc., the net profit was Rs. 32,522, giving an all-round rate of Rs. 81 per acre.

In the following year, only one block of 131 acres was worked departmentally, the growth on the other three being sold as it stood. The result of the departmental operations was 4,373 tons of wood brought to dépôt, an expenditure of Rs. 6,747 having been incurred thereon, sold for Rs. 17,817, giving a net profit of Rs. 11,070 and an average all-round rate per acre of Rs. 85. The sale of the standing growth brought in Rs. 9,485, or a net revenue of Rs. 36 per acre, the area sold being 262 acres. In the year 1901-02, one block was again worked departmentally, 2,105 tons of wood having been brought to dépôt at a cost of Rs. 2,296. The wood sold for Rs. 9,526, giving a net profit of Rs. 7,330, or Rs. 77 per acre, the area of the block being 95 acres.

The remaining three blocks, aggregating in area 278 acres, realised Rs. 15,275, or Rs. 54 per acre.

3. Since the year 1902 all the blocks have been sold as they stood ; in the first year Rs. 20,467 having been realised, in the next Rs. 31,775, and in the third, the current year, Rs. 38,000, giving net profits per acre of Rs. 62, Rs. 87, and Rs. 107, respectively. The somewhat low rate per acre realised in 1902-03 is partly attributable to the exceptionally poor growth in one of the compartments (No. 1 of Tamminipatnam) offered for sale, but with this exception the prices realised during the later years are, taking them all round, far in advance of those previously obtained, and, I believe, are attributable, in a large measure, to the satisfactory working of the tramway as compared with former years.

The larger profits can hardly be said to be due to the exceptionally large or old trees sold in those years as the following figures will show :—

The ages of the several blocks sold between the years 1900 to 1904 were more or less uniform, the estimated outturn, after an actual enumeration of the trees in each block, being as follows :—

Three blocks sold in 1900-1901.—Estimated outturn 3,500 tons ; price realised, Rs. 9,485.

Three blocks sold in 1901-1902.—Estimated outturn, 7,000 tons ; price realised, Rs. 15,275.

Four blocks sold in 1902-1903.—Estimated outturn, 6,000 tons ; price realised, Rs. 20,467.

Four blocks sold in 1903-1904.—Estimated outturn, 9,000 tons ; price realised, Rs. 31,775.

Four blocks sold in the current year.—Estimated outturn, 7,400 tons ; price realised, Rs. 38,000.

Early this year it was said that there was a brisk demand in Madras for casuarina wood, but of this I cannot speak with certainty. It is probable, however, that the actual demand was no greater than in past years.

4. Mr. Popert on the last page of his "Note on Casuarina Planting" estimates the cost of a fully established plantation at Rs. 33 per acre, but the results obtained here during the past few years show that this estimate can be greatly reduced. It is not possible to give figures relating to more than nine blocks, five of which were planted up in 1900-01, and the remainder in the following year, and which are, therefore, fully established plantations under the prescriptions of the working plan. The expenditure on the first five blocks gives an average cost of Rs. 31 per acre, a figure which is much the same as that given by Mr. Popert ; but the next four blocks show only Rs. 20 as the cost incurred on their establishment, and there is reason to believe that even this can be further reduced.

The details of the several operations which make up the aggregate of Rs. 20 per acre are—

	Rs. a. p
Preparing the land for planting, digging wells, and planting out (including nursery charges)	... ... 2 12 0
First year watering charges	... ... 11 8 0
Second year watering charges	... " 5 0 0
Third year watering charges	... ... 0 12 0
	<hr/>
Total	... 20 0 0

The average rainfall for the years 1870 to 1899 at the two recording stations on the coast (Dugarazpatnam and

Krishnapatnam) was 36·16 and 37·21 inches respectively. At the same stations, during the three years ending 1903 the average was 38·32 and 41 inches. It may therefore be said that the years in which Rs. 20 per acre were spent were years of normal rainfall.

The rainfall having been normal, water was not more accessible, nor can it be said to have been less required during those years. Earlier planting has, of course, produced better results, but the true answer to the question is, I believe, a much closer control, than formerly, over the expenditure.

5. The estimated yield, as found by Mr. Popert, of a plantation over ten years old, *viz.*, 49 tons per acre, seems too high. The results of the working of the casuarina plantations in this district during the past four years give an average yield per acre of only 25 tons the average age of the trees in the several blocks felled over being very much more than ten years, and this, I think, will be found to be the more accurate figure.

Accepting Rs. 3·8·0 as the average selling rate per ton, the figures would work out as follows :—

	Rs. a. p.
Revenue	... 87 8 0
	Rs. a. p.
Cost of planting per acre ...	... 20 0 0
Interest at 5 per cent for 10 years ...	... 10 0 0
Establishment charges at 5 per cent for 10 years ...	... 10 0 0
	— 40 0 0 —
Total Net Revenue	... 47 8 0

As regards value of tramway plant, Rs. 20,000 has, as nearly as possible, been spent on it up to date. The charge per annum may therefore be put down at—

	Rs.
First year—	
Interest at 3 per cent on Rs. 20,000	... ... ... 600
Depreciation at 4 per cent	... ... ... 800
	— 1,400 —

Rs.

Second year—

Interest at 3 per cent on Rs. 19,200	...	...	...	576
Depreciation at 4 per cent	...	...	...	763
				1,334

Third year—

Interest at 3 per cent on Rs. 18,432	..	...	...	552
Depreciation at 4 per cent	...	...	...	736
				1,288

Fourth year—

Interest at 3 per cent on Rs. 17,716	...	...	...	531
Depreciation at 4 per cent	...	...	...	708
				1,239

Fifth year—

Interest at 3 per cent on Rs. 17,008	...	...	...	510
Depreciation at 4 per cent	...	...	...	680
				1,190

Sixth year—

Interest at 3 per cent on Rs. 16,328	...	...	...	489
Depreciation at 4 per cent	...	...	...	652
				1,141

Seventh year—

Interest at 3 per cent on Rs. 15,676	...	...	...	470
Depreciation at 4 per cent	...	...	...	628
				1,098

Eighth year—

Interest at 3 per cent on Rs. 15,050	...	...	...	450
Depreciation at 4 per cent	...	...	...	600
				1,050

	Rs.
Ninth year—	
Interest at 3 per cent on Rs. 14,450	... ... 433
Depreciation at 4 per cent	... ... 576
	<hr/> 1,009

	Rs.
Tenth year—	
Interest at 3 per cent on Rs. 13,884	... ... 416
Depreciation at 4 per cent	... ... 555
	<hr/> 971

Total interest and depreciation for ten years is Rs. 11,725, or per annum Rs. 1,172.

Assuming cost of tramway, first rotation, to be Rs. 11,725, the cost per acre is $\frac{11,725}{3,712} =$ Rs. 3-2-6 nearly. The second and subsequent rotations would cost much less, but there would be constant repairs, and something must be allowed for replacing machinery. The cost under this head may therefore be fairly placed at Rs. 3-8-0 per acre. The total cost per acre inclusive of all charges is therefore Rs. 43-8-0, giving a net revenue of Rs. 44 per acre per annum.

RAMIE *versus* FLAX.*

For the past number of years flax spinners have been labouring under the disadvantages of dear and dirty flax crops from Russia, where the largest proportion of the fibre used in Scotland comes from ; with the exception of the period of the South African war, when the demand from our Government for material for tents and covers was very great, and when the question of price was not the most important factor, but quick delivery, the past number of years have been very poor years for those engaged in this industry. Year after year the crop gets poorer in quality, the old-fashioned method of retting the straw from the flax gets less

*Extracts from a note forwarded to the Hon. Editor by Mr. D. Edwards Radelyff of Staines, England.

attention in the hurry of the peasants to get their crop into the market and realised, or the crop is so late that a great part of it, either in the process of drying or retting, is caught by the snow, and does not therefore come to market until the following spring; or a backward season makes the flax late in being pulled, and the water in which the flax is retted is too cold to do so properly or the seed is too poor in quality to produce good clean flax. We have also to consider the old-fashioned methods of cultivation employed by the peasants. The chronic state of poverty, which is the rule rather than the exception, hinders them from properly manuring the land to produce better crops, so year by year the ground gets more unfruitful by reason of their inability to follow proper methods of cultivation.

Such are only a few of the disadvantages under which flax spinners have to labour. We will now consider the prospects before ramie.

If ramie were cultivated to such an extent that it could be imported to this country in hundreds of tons, then the long suffering flax spinners would welcome it and see in it their salvation, and then no longer would be heard the wail of those who now speak of flax manufacture as a decadent industry. With the coming of ramie, a new era with additional industries following in its train, and the prospect of prosperity, would arise.

Never has the textile world had an opportunity offered like the present. Cotton suffers periodically from causes brought about by unscrupulous gamblers whose tactics are fostered by our fore-fathers' short-sightedness in not encouraging cotton-growing in our own colonies. Even now fully 80 per cent of the cotton production is in one nation's hand; then there is the competition of France, Germany and America as cotton manufacturers together with the world's increasing population requiring cotton faster than it can be produced. All this plays into the hands of cotton gamblers, and so we are periodically squeezed. Yet here again ramie can play the part of rescuer. The British Association brought out fully the enormous hardships and losses our cotton operatives sustained. The Chairman admitted 15 millions per annum loss, to say nothing

of the fearful misery to the starving operatives. Mr. Balfour pointed out that these evils were only to be avoided by a substitute. He illustrated his argument by corn. It was difficult, he said, to corner wheat as there were substitutes such as barley, rice, maize, oats and the like which, when wheat reached an abnormal price, were ready to take its place. This substitute for cotton is at hand in ramie; the short noils, a by-product, are even better than cotton and could be utilised by the cotton spinners in case of shortage.

The Cotton Association is doing good work in fostering cotton-growing in our colonies, and it would do well to encourage ramie as well. It grows where cotton grows, and where it does not, it has a much larger field. There is an enormous opening for ramie, and our sugar and indigo planters, to say nothing of tea, which has reached over production, would find enormous profits in ramie. A report I prepared for the Government, evidence obtained from chambers of commerce, technical schools, professors, manufacturers, brokers, spinners, weavers and others, may be summed up as "There can be no two opinions as to the merits of this wonderful fibre; it could and would be used in vast quantites if regular supplies can be assured at fair and reasonable prices."

A FLOWERING OF DENDROCALAMUS HAMILTONII IN ASSAM.—Mr. F. H. Cavendish, Deputy Conservator in charge of the Lakhimpur Division in Assam, reports in a letter, dated June 9th, 1905, that the bamboo *Dendrocalamus Hamiltonii* has just flowered in a wholesale manner in the forests of that Division. According to report it is, he states, some 30 years since this bamboo was last in flower there.

THE SALE OF DIVI-DIVI PODS.—We have received the following communication upon this subject from Mr. J. A. Daly, Extra Assistant Conservator, Coimbatore Division, Madras :—

There are 29 fruit bearing Divi-divi (*Cæsalpinia coriaria*) trees in the Government timber dépôt compound at Coimbatore. During 1903-04 they yielded 1,441 lbs. of pods, which were shipped through Messrs. Pierce, Leslie & Co. of Coimbatore to Europe, and

the net revenue per maund of 25 lbs. was Re. 0-6-5. During 1904-05 they yielded 2,100 lbs. of pods, which were sold to Messrs. Wilson & Co. of Madras, and the net revenue per maund was Re. 0-10-5.

From the above it will be seen that it is more profitable to dispose of the pods in Madras, and that on an average $2\frac{1}{2}$ maunds is the yield of each tree per annum, which at the Madras rate fetches Re. 1-10-0.

On this basis of calculation an acre containing 100 trees ought to bring in a revenue of Rs. 162-8-0 per annum, which looks very promising.

THE "INDIAN FIELD" SHIKAR BOOK.—We feel sure that many of our readers will be glad to peruse the following announcement, which we extract from the *Indian Field* :—As we announced in a recent issue, it is our intention to produce a third edition of *The Indian Field Shikar Book*. The misunderstanding that led to the withdrawal from circulation of the few remaining copies of the second edition, and regarding which we have already taken our readers into our confidence, in no way precludes us from publishing other editions of the book, provided, of course, they do not trespass upon the rights of Mr. Rowland Ward over such records of big game as he has already published and copyrighted. We propose to entirely recast the big game section of *The Shikar Book*, and, while entirely doing away with the tabulated matter relating to trophies, to give sportsmen all the records, but more especially those details of fine trophies *recently shot* and which must, after all, be of more interest than matters of "ancient history." Since the publication of *The Shikar Book* we have received from sportsmen all over India hundreds of big game measurements and scores of details of trophies which have not hitherto seen the light of publication, and we are promised by several well-known shikaris much valued information under this head, which must make the book more useful than before. We appeal to sportsmen to assist us by sending in details of fine heads recently bagged, together with measurements of tiger, bear,

panther, rhino, etc. Should the response come up to anything like our expectations, we should be able to bring out the third edition by next Christmas.

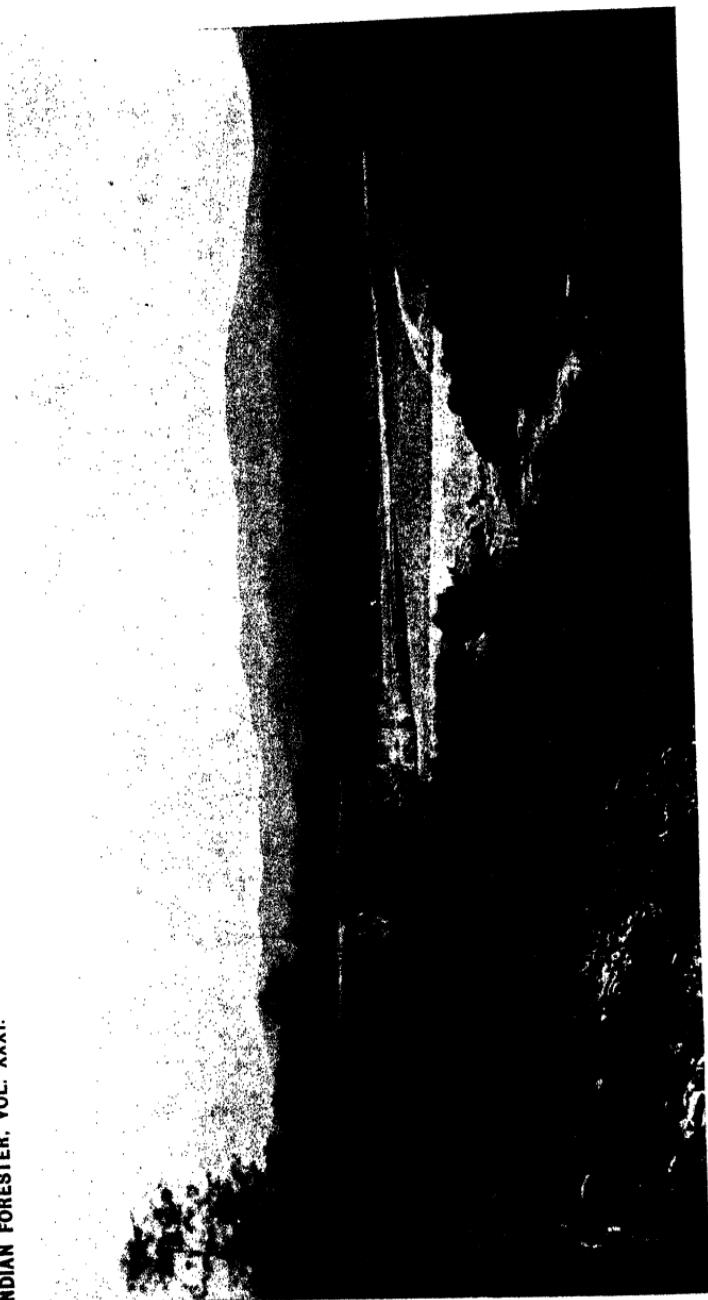
SPRUCE FOR WOOD PAVING.—There appears to be a reaction developing in favour of a more general return to softwood paving. Archangel and Baltic deals, suitable for this purpose, can now be obtained at reasonable prices, and there are many thoroughfares where the traffic is not sufficiently heavy to justify the extra expense of hardwoods. Spruce has hitherto been barred for paving purposes on account of its refusal to absorb creosote, but we understand that by the Powell sugar treatment of spruce, blocks can be produced to meet all the requirements for wood paving in the way of seasoning, non-absorption and antiseptic character.

A "NERVE" DISCOVERY.—An interesting discovery was announced by Dr. Head, F. R. S., in an address on "A New Aspect of the Sensory Nerves" delivered to the Royal Medical and Chirurgical Society at Colombo a short time ago. Dr. Head said that he had the sensory nerves in his own arm divided, and watched the various sensations disappear. The nerves were then reunited by stitching, and the process of recovery carefully watched day by day. As a result he has discovered that there are two entirely distinct sets of nerves to the skin carrying different kinds of sensations. The first set convey sensations of pain, heat, and cold; the second set carry sensations of touch, and enable us to localise our sensations accurately. The healing power of the skin depends entirely upon the first set.

NILGIRI NETTLE FIBRE.—Professor Wyndham R. Dunstan, M. A., F. R. S., Director of the Imperial Institute, has submitted a valuable report upon a sample of Nilgiri Nettle Fibre (*Girardinia Leterophylla*), which was sent home to him. There have been many inquiries at the Indian Museum regarding the value of the fibre of this nettle, and Professor Dunstan's report will, therefore, be all the more acceptable. The nettle grows in most Indian hill stations, and the sample sent home was obtained from

Darjeeling. Professor Dunstan states that the fibre is silky, of good strength, and possesses a remarkable length of 6—20 inches. Although prepared by the ordinary retting process and without chemicals, the fibre is valued at £20 per ton.

A CEYLON SILK DIFFICULTY.—An unexpected and unforeseen difficulty has cropped up in connection with the movement for taking up the production of silk in Ceylon. The demand is now almost entirely for unpierced cocoons, for the turning out of which it is necessary to destroy the pupa inside. The unpierced cocoons fetch ten times the price of pierced ones. All life is held sacred in Buddhist beliefs, and the question is how far this will prove an insuperable barrier to the development of the industry in an island where so large a proportion of the population are Buddhists. The act of destroying the pupa would be in distinct contravention of the Five Precepts, which prohibit the taking of even insect life. So strict, indeed, is the Buddhist law in this respect that the priests are enjoined not even to destroy vegetable life.



F. Beeson Bryant, Photo.
Boxar on the Ranganga River at the lower end of the Path Dun, N.-W. Himalayas.

INDIAN FORESTER

SEPTEMBER, 1905.

FORESTRY TUITION IN BRITISH UNIVERSITIES.

We have recently had the opportunity of perusing a most interesting Blue-book on the "Correspondence relating to the Training of Forestry Students." The correspondence deals primarily with the training of the probationers for the Indian Forest Service, although incidentally the question of the preparation of men for forest work in the British Colonies is touched upon. The subject arose, as many of our readers will readily understand, owing to the decision to close Coopers Hill, whereby the forest branch of that institution was left homeless. Into the controversy which subsequently took place as to whether the probationers should be trained, *i.e.*, whether a Forestry College or Branch should be founded, at Oxford or Cambridge or one of the more Northern Universities, it is not necessary to enter here, although the Blue-book has much to say upon the subject. We know now that Oxford was the University finally advocated by Dr. Schlich, and accepted by the Secretary of State as a tentative measure for the next three years.

As the matter and entrance examination now stand, the selection of Oxford practically confines the entrance examination, as far as Cambridge is concerned at any rate, to the Sister University, for it is hoped that men who have already done a year at that University and passed Responsions will compete. Although the Little Go of Cambridge will serve equally well it is held by that University, with probably a considerable show of reason, that men who have already passed a year at Cambridge will not go over to Oxford, and therefore will not compete in an examination which will entail their going into residence at the Sister Institution. Cambridge, whilst not asking for the whole of the Indian forestry probationers,

held that equal recognition should be given by the Indian Government to both Universities, and that a Public Service should not be closed to the one by the formation of an endowed Forestry Branch at the other. They wished any funds granted by the Secretary of State for India towards a Forestry College to be equally divided between the two Universities, and that they should be then left to work out their own salvation. It may be readily admitted that the Cambridge authorities had not grasped the full significance of the matter and entirely failed to understand the absolute necessity, in the present state of forestry tuition in Britain, of the Indian forest probationers being trained at one spot and under one staff. But whilst we consider that this point admits of no contradiction, there are others in the Cambridge arguments which we are prepared to view with the approval they merit and to give our warm support to; for although, so to speak, groping in the dark and speaking without being able to advance any definite proof on the subject they were nearer to the truth than they were perhaps aware of.

After a certain amount of correspondence had passed between the India Office and the Sister Universities the Cambridge authorities suggested that a Conference should be held to discuss the question at which representatives from both Universities and the India Office should be present. The Secretary of State readily fell in with this proposal, and the Conference was held at the India Office on the 2nd February, the following members taking part:—Sir John Edge, K.C., Chairman; The President and Prof. H. A. Meirs, F.R.S., of Magdalene College, Oxford; The Master of Gonville and Caius College, and Mr. A. E. Shipley of Christ College, Cambridge; Sir Charles J. Lyall, K.C.S.I., C.I.E., Mr. T. W. Holderness, C.S.I., Sir Dietrich Brandis, K.C.I.E., F.R.S., Dr. Schlich, C.I.E., F.R.S., and Prof. W. R. Fisher.

At this Conference the question as to which University would offer the greatest facilities for the training of the forest probationers for the Indian Service was fully discussed. We are not concerned in this article with the somewhat lengthy arguments brought up on either side except in so far as they relate to the tuition of the subject

of forestry itself. On this point we cannot think that it would be in the interests of the Service in India to pass over in silence the amazing, for we can look upon it in no other light, dicta laid down and accepted by most of the Conference. It was stated, and two former Inspectors-General to the Government of India were responsible for the utterance, that it would be impossible to find within the ranks of the Service in India men capable of filling a professorial chair of forestry. Whilst many of our readers will doubtless read this statement with incredulity the evidence recorded in the Blue-book unfortunately admits of no misconstruction. A few quotations may be given in support of this remark. Cambridge were pressing for equal recognition with Oxford, asking that the money the India Office was prepared to spend upon the provision of an efficient forestry staff for the training of the probationers might be divided equally between the two Universities. To this Sir Dietrich Brandis replied that competent Professors of Forestry were scarce in English-speaking countries at present, and Dr. Schlich continued by pointing out that he only wished to see the new departure through before retiring "Some one," he said, "will have to take my place, but there are not so many men available, even in the Indian Forest Department." That this evidence was accepted as a true representation of the facts is evidenced by the remark of the Chairman later on. "I think we might consider it" (*i.e.*, the question of establishing the forest probationers at Oxford or Cambridge) "now on the assumption—I do not know whether that is decided—that we can only find one competent staff of men who have been trained in forests in India as lecturers." The recorded evidence of the subsequent proceedings shows that this assumption was held to be the correct one, although Cambridge, without any real knowledge of the real state of affairs, remained frankly sceptical upon the point.

Now we venture to think that it is quite impossible for the Department in India to sit passively under the stigma thus put upon it. What do the statements rest on? The evidence of two men—men whom the whole Service reveres as practically the founders and creators of the Department in India—men who were each

respectively Inspector-General in their time, but men one of whom left India 24 years ago and the other 22. Not only were these men the creators of the Department but they alone are responsible for the tuition of the staff which now rules and mans it. Do they think so little of their own work as to hold the opinion that none of their former pupils are capable of succeeding them in the fulness of time or of filling professorial chairs in other Universities? Do they think that the Département has stood still for a quarter of a century, and if they think so upon what evidence do they base their opinion? Would, we ask, such evidence, after an absence of 20—25 years from a country such as India, be worthy of acceptance against that of the Department itself. Each one of us knows that it is difficult to credit another man with the requisite capabilities for carrying on the work one is engaged upon, and yet what is the evidence of the world? Ruthless it may seem, difficult to believe it may be, but it is inexorable. No one is indispensable! We are ready to admit that in some respects, such as the formation of a Scientific Bureau of Forestry for instance, we have been backward, but the recognition of this fact has come from the Department itself and not from Home.

But we are not here concerned with this aspect of the case nor with replacing the Professors of Forestry who have so ably taught the subject at Coopers Hill and who are now proceeding to Oxford. We feel sure that the whole Department will join us in the wish that they may long continue in the position they occupy and superintend the theoretical part of the training of our recruits. We are not concerned with their position, but we do most emphatically and distinctly repudiate the statement that it would not be possible to find within the ranks of the Service in India a Professor—aye, and half a dozen—of Forestry who would be capable of filling with distinction a professorial chair at Cambridge or any other British University who might wish to found such a chair. The contention admits of no cavil that forestry and the Forestry Department have, within the last decade or two, made strides in India which are quite beyond all power of recognition by those at Home and could only be realised by a professional forester after a lengthy tour in

the country. That the evidence of our former Inspectors-General rested on no such experience and could have been founded only on such casual visits as may have been paid them by officers on furlough is, we think, in itself sufficient to exonerate the Department from the grave stigma laid upon it, without any further remarks upon our part.

In conclusion we would inform Cambridge or any other University possessing the will to found a Forestry Chair that the Indian Forest Service contains within its ranks in India men who, having received the highest professional training it was possible to give them in Europe, have kept themselves *au courant* with forest literature and forest matters the world over, and in the course of carrying out their own arduous duties in India have acquired a ripe experience which would enable them, should they care to do so, to fill a Forestry Chair with credit to themselves, to the Department which has educated them, and to the University employing them.

SCIENTIFIC PAPERS.

SOME INDIAN FOREST FUNGI.

BY E. J. BUTLER, M.B., F.L.S.

CRYPTOGAMIC BOTANIST TO THE GOVERNMENT OF INDIA.

To one interested in the lowly mushrooms and moulds India, at first, often comes as a disappointment. Before experience one pictures all tropical countries as teeming with rare and beautiful forms of plant life, and there is no hint that the fungi are to be, even partially, excluded from the scene. The reality is in many cases a cultivated plain or a paddy swamp extending as far as the eye can reach. Of fungi there are few, and these often familiar crop pests. There are no moist woodlands as in Europe. The trees are mango groves, or palms clustered around the villages, or avenues of shade-trees bordering the roads. Even the jungle is too often dry scrub, the last place in which fungi could flourish.

The odour of decay is absent, fallen leaves are scarce, decaying branches—most loved of fungi—are almost unknown. For in India life is too hard to allow of anything that burns being left to waste. There are, too, few old fences, or grassy slopes moist from the shade of trees, or any, except rarely, of those other favoured spots to which the mycologist must look to gather his harvest. The reasons for this are simple. The population is very dense, with consequently a close cultivation of the land. Added to this is, in the parts to which I refer, a climate too dry for the greater part of the year and often too heavily flooded in the rains to permit of that gradual return to the soil of organic matter in which the fungi find their most favourable conditions of development. I can hardly imagine anything more unsuitable looked at from this point of view than the plains of Northern India from the Punjab to Behar or the bare uplands of the Deccan.

But there are great areas in the continent, often away from the beaten track, in which all these conditions are changed. The region at the base of the Himalaya and the slopes of the hills themselves as high as the forest vegetation goes, much of South India, both the moister mountainous parts and the tracts along the coast, all of the Ghats, much of Lower Bengal and Assam are rich in fungi. In the forests of these regions, amongst which are some of the most important in India, there is a vast amount of material awaiting collection, and there are few in India with such opportunities of helping a much-neglected branch of science as the officers of the Forest Department in these places.

In the following notes reference is made to parasitic fungi only. These, though independent of decaying plant-food, getting their nutriment as they do from the living tissues, find in the forest conditions of moisture and shade most favourable to their development. So far as my experience goes the parasitic forest fungi enormously exceed those of the open country in number, though their economic importance is less evident.

That the study of fungi is a necessary branch of forest science need scarcely be remarked. Their importance in forest economy will be evident to any one at all acquainted with the

work of German mycologists. The results obtained in that country are largely applicable to the rest of Europe. In India, however, we can draw only to a slight extent on experience elsewhere, and there is, as yet, little to offer in its place. Even where the parasites are identical the trees on which they live are usually distinct, and it is at least possible that the mode of action differs with the different hosts. In the well-known conifer parasite, *Fomes annosus*, the extension by *rhizomorphs* is a characteristic feature of its attacks on the deodar in the Himalaya, while these organs have not been described for the same fungus in Europe, either because they do not exist or, as Prof. Mayr believes, because they have escaped attention. In any case they can hardly be as well marked as in India. But it is probable that the majority of our parasites are entirely different to those of Europe and America, and the fact that a larger number of new forms have not been brought to light is only an evidence of our want of knowledge of the subject.

I have received several specimen of parasitic fungi on forest trees and shrubs within the past two or three years, mostly through the kindness of Forest Officers. Some of these have been the cause of very considerable damage, as in the cases of *Fomes annosus* on deodar, *Fomes Pappianus* on babul, *Trametes Pini* on *Pinus excelsa*, the *Trichosporium* on casuarina, &c. Others, such as the rust fungi of conifers and Ephedra and of the barberries, are of less account. But even the latter are often of great interest from their indirect influence on the diseases of cultivated crops or important industries such as tea and coffee planting. For instance rust on cereals has often been attributed to the fungi of the Himalayan forests, and there is no doubt that this view has influenced considerably those in India who have given thought to these diseases. The *Rosellinias*, fungi which arise in the decaying stumps of many trees, have proved a serious trouble in tea and coffee cultivation, giving rise to constantly expanding patches of what is known as "stump rot" in many estates, within which every bush is destroyed. If taken early they can be checked, and their prevention by a proper treatment of the tree stumps seems not beyond

the bounds of possibility. The forester who can devise a satisfactory and cheap method of destroying stumps after felling by burning or blasting, or who can show how to preserve a stump from rotting in the mass, will confer a real benefit on planters in India. From a disease of this nature, combined with another parasitic fungus, the cultivation of pepper on a large scale in Mysore, which is otherwise full of promise, has been prevented. Again, there is the remarkable group of host-changing fungi—the *Uredineæ* or rusts—about whose life-history the late Dr. Barclay has told us so much. Large numbers of these are known in India, in one stage only, and the other stages are probably passed on different plants. Some of these in the forests may be found to have a direct bearing on crop diseases. And leaving out of consideration altogether the economic aspect, the forests are full of interesting forms, capable of throwing light on obscure questions as the rhododendron rusts perhaps do in one direction, or of affording valuable materials for study. Our collections of Indian fungi are as yet very meagre. We do not even know the identity of the species which produce the phosphorescence noticeable in the forests in some places, nor completely the identity of the edible forms of India. If, then, Forest Officers whose locality offers them the opportunity can be induced to collect and study the fungi of their districts, both those injurious to trees and those otherwise of interest, a great advance in our knowledge of a little-known subject will almost certainly be the result.

TRICHOSPORIUM DISEASE OF CASUARINA.

The Casuarina plantations on the sand dunes of the East Coast are subject to several diseases. Some of these are due to insect pests and have been described in this Journal by Mr. E. P. Stebbing (*Indian Forester*, September 1903). One, however, which I saw in the Chatrapur plantations with Mr. C. Fischer, I. F. S., in August 1904, is of a fungal character, and being one of those slow and steadily progressing diseases which may eventually become a serious matter, requires more than passing notice.

Attention appears to have been first called to the fungus attack during Mr. Stebbing's visit in July 1903. Amongst the dead trees, of which there were a number in the plantation, some were found with the bark raised up into great blisters, and eventually ruptured by the formation of a black powdery substance consisting of myriads of spores of a fungus. Enough of this powder was easily collected to fill a small box. It appeared on very few trees, however, and the idea that it was connected with the disease was for a time abandoned by Mr. Fischer. When we walked through the plantation only two or three instances were found, and the majority of the dead trees, of which several hundreds were seen, had perfectly normal bark with no sign of the presence of any parasite.

The trees died out in patches, of which two or three large and several smaller ones occur within the Agusti Nowgam plantation. No reason could be given why some parts of this plantation were failing, while the rest flourished. But the examination of specimens collected during my visit and of others subsequently sent sufficiently explained the matter. A parasitic fungus was found within the central wood, which there can be little doubt is the cause of the disease. It is, curiously enough, apparently identical with that first found in the bark, some minor differences in structure and measurements being probably due to the different conditions of life passed buried in the wood, and that passed in the cambium where access to the outside world becomes possible by the rupture of the bark. Why it should sometimes remain internal and sometimes break out on the surface is not clear.

In the earlier stages the trees look sound enough, even when the collar is exposed, except that many of the twigs are dead and clusters of withered needles remain attached to them, the whole appearance suggesting water-logging or drought. The extension of the dead patch from which the specimens were taken in a centrifugal manner up a sharp slope of the sand, which is here very deep, and the healthy state of the adjoining trees put these possibilities, however, out of the question.

The internal fungus was found in the specimens examined in a part or the whole of the wood of the collar, extending six or eight inches below the surface of the soil and a few inches above. It occupies the centre of the wood, reaching in one or two places to the vicinity of the cortex, but elsewhere separated from the exterior by an inch or more of sound tissue. It is not visible to the naked eye, but in some cases is accompanied by a discolouration of the wood, visible on section. In some of the specimens

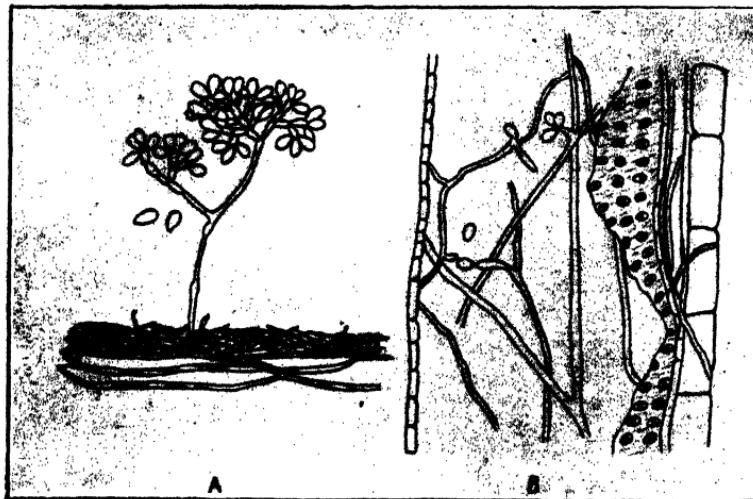


FIG. 1.—TRICHOSPORIUM ON CASUARINA ; *a*, BARK FORM ; *b*, INTERNAL FORM WITHIN A WOOD VESSEL.

it was impossible to determine if the fungus were present or not without microscopical examination. The wood of many of the lateral roots is also discoloured, and where they enter the tap root their passage through the exterior tissues is sometimes distinctly visible as dark streaks. These lateral roots as well as the diseased patch of collar wood contain fungus hyphæ, while the rest of the tissues are quite free from them.

The hyphae lie within the vessels and cells, boring their way through any intervening cell-walls. Both brown and colourless ones, belonging to the same mycelium, occur, in some parts the brown predominating, while in others only colourless can be found. In the smaller roots brown hyphae are rare. On lateral branches from the main filaments spores are borne at or near the apex in small clusters. They are at first more or less spherical and colourless, but later become oval and brown, falling easily and lying within the vessels. Their utility in this position can be but slight, for none were found in the smaller roots and decay of the collar sufficient to liberate the spores would probably take some years. Unless the fungus also forms spores in the soil, its propagation is likely, so far as the subterranean form of attack is concerned, to be mainly vegetative by means of a soil mycelium extending from root to root through the ground. The centrifugal progress of the disease from a few centres lends support to this view.

The destruction of the wood is not considerable. All the contents of the cells invaded by the hyphae are destroyed and a brown residue fills those which have had living contents, such as the parenchyma, giving rise to the discoloured appearance of the diseased tissue sometimes observed. Lignified tissues are but slightly attacked, and there is no change apparent in the walls of the fibres until a late stage. The effect of the fungus on the tree is greater than would appear warranted by the mere destruction of the living contents of the cells, and the physical result of blocking of the vessels with hyphae. It is probable that the death of the trees is largely due to ferment production, or the formation of some poisonous substance thrown into the sap, as happens in so many cases of the sort. In the sugarcane red-rot for example the fungus *Colletotrichum falcatum* is often confined to one or a few internodes near the base of the cane, but the total crystallisable sugar is greatly diminished by the action of a sugar-inverting ferment, formed by the fungus and acting on the sugar-containing sap. The greater part of the damage is apparently due to this ferment.

The bark-rupturing fungus, first observed, produces far more striking effects.

The bark is lifted from the cambium along the trunk into great blisters by the formation here of a layer of densely woven hyphæ, which produce spores in such abundance that the black powder composed of them is sometimes a quarter of an inch in depth. Later on these blisters rupture, raising the bark in loose sheets



FIG. 2.—CASUARINA STEM ATTACKED
BY TRICHOSPORIUM.

and exposing the spores. The tissues under the spore-producing layer are invaded everywhere by hyphæ, which are colourless in the outer cells and sometimes brown deeper in. Microscopically no difference can be observed in the mycelium of this from that above described, except that the portion from which the sporophores arise is invariably colourless. The spores in this case are also rather larger and their colour deeper brown. They are borne

on hyphae of variable length and often branched, each branch bearing a cluster of spores near its tip on the main axis or on short thick branches of the secondary or tertiary order. Branched sporophores of this type were not observed in the internal form, but the latter was much more difficult of examination and the spores were very rarely found fixed *in situ*.

In the absence or rarity of the external mode of fructification and from the nature of the diseased patches, it is probable that the fungus extends through the upper layers of the soil from root to root. Hence the only suggestion for treatment which can be made at present is to remove as early as possible all diseased trees to prevent the bark-destroying form, which appears to be of late appearance, from developing. The collar and main roots should also be removed in trees near the margin of the diseased patches as far as possible. Trenching might prove effective in checking progress, but further observations and trials are necessary before the efficacy of this can be established. After clearing it will be unsafe to replant for some two years or so as the fungus is likely to persist for some time in the smaller roots which are left.

This fungus possesses many points of resemblance in the bark form to another tree-destroying fungus found by Mr. Massee of Kew on mulberry trees sent him from Changa Manga, in the Punjab. The mulberry fungus which Mr. Massee named *Trichosporium aterrimum* is also made manifest by a rupture of the bark from the cambium in which its spores are formed. The minute structure, however, differs in some respects, particularly the size of the hyphae and the mode of origin of the spores, though the specimen which I examined from the Forest School Museum was not entirely satisfactory for determining the minute characters of the fungus. In any case the name *Trichosporium aterrimum* cannot stand since it has already been used by Saccardo for a species of Corda's (*Sylloge fungorum IV*, p. 289). I have named the Casuarina fungus *Trichosporium vesiculosum* n. sp. and the diagnosis is as follows:—

Trichosporium vesiculosum n. sp.—Hyphae brown or colourless within the tissues or forming colourless cushions in the cambium;

fertile hyphae colourless, $1\frac{1}{2}$ to 2 micro-millimeters in diameter, bearing clusters of spores inserted at or near the tip on the thickened end of the main axis or of secondary and tertiary branches, several on each branch; spores sessile, ovoid, brown, in the mass black, forming a dense layer in the cambium fewer in the tissues, $5-8 \times 4\frac{1}{2}-6$ for the external and $6 \times 4\frac{1}{2}$ micro-millimeters in diameter for the internal.

Parasitic on *Casuarina equisetifolia*, which it kills—Chatrapur, Ganjam, India.

Allied to *Trichosporium aterrimum*—Massee not Saccardo.

ORIGINAL ARTICLES.

THE EFFECTS OF THE GREAT FROSTS OF 1905 ON THE FORESTS OF NORTHERN INDIA.

IV.—THE EFFECT OF THE UNPRECEDENTED COLD WEATHER ON THE FOREST VEGETATION IN MONTGOMERY DISTRICT.

BY GHULAM MOHAMAD

EXTRA ASSISTANT CONSERVATOR OF FORESTS.

(1) As the climate of the Montgomery district is dry and the soil is arid, the severe cold and low temperature of the past winter has very much affected the forest growth.

(2) The usual time of opening of the new buds is the spring season, but owing to the severity of last cold weather the new shoots were a month late. As the trees did not produce new shoots at the proper time, the annual growth of the forest crop has been checked. Moreover, the trees have yielded no seed, hence natural reproduction during the following season will be entirely absent.

(3) The most remarkable effect of the frost has been that a large number of trees, especially those which have thin bark, like karil (*Caparis aphylla*) have dried up. *Acacia arabica* (kikar), *Prosopis Spicigera* (jand), *Silvadora* (wan) have produced no seed at all. The growth of young plants and coppice shoots has been checked and many of them have dried up.

V--ON THE DAMAGE DONE TO THE FOREST GROWTH IN THE PILIBHIT DIVISION.

COMMUNICATED BY THE CONSERVATOR OF FORESTS, OUDH CIRCLE.

The damage caused by frost in the forests of the Pilibhit Division in 1904-05 is far in excess of that in previous years. The species which suffered most are—

<i>Shorea robusta</i>	...	...	(Sal)
<i>Terminalia tomentosa</i>	...	...	(Assaina)
" <i>belerica</i>	...	...	(Bahera)
<i>Buchanania latifolia</i>	...	...	(Piar)
<i>Phyllanthus emblica</i>	...	...	(Aonla)
<i>Stereospermum suaveolens</i>	...	...	(Pandor)

The species which suffered least are—

<i>Eugenia Jambolana</i>	...	...	(Jamun)
" <i>operculata</i>	...	...	( " )
<i>Wendlandia exserta</i>	...	...	(Birsa)
<i>Diospyros tomentosa</i>	...	...	(Tendu)

The sal suffered most in the open blanks which occur very frequently in these forests and are called "Chanders." In these Chanders the sal seedlings are annually killed back by the frost. In the following year the plant sends up coppice shoots, which are in their turn killed off by the frost. Occasionally a few of these shoots escape, and if they are fortunate enough to escape for several years, they grow up out of reach of the frost and so develop into trees. This year the frost destroyed, in addition to all the small shoots, all those which had escaped for several years, and in some cases sal trees up to 35 ft. in height were killed. Round the edges of the Chanders, where the young sal trees are generally protected from the frost, great damage was caused this year.

The frost even penetrated right into the forests and killed off young sal trees standing under a fairly dense canopy. In many places the twigs of the lower branches of big trees dried up. The total absence of fruits of the *Terminalia belerica*, *Phyllanthus emblica* and *Buchanania latifolia* in some places this year is said to be the result of the frost. The sal does not seem to have been affected in this way, and has seeded profusely.

The damage by frost is more apparent in the southern parts of the Division. The northern parts, which are closer to the hills, have not suffered so much.

THE PÁTLI DUN.

Mr. Hobart-Hampden has very kindly furnished the following information on the subject of our frontispiece, which is from a photograph taken by Mr. F. Beadon Bryant, Conservator of Forests, showing the scenery in the Pátli Dun: "The scene represents Boxar on the Ramganga River at the lower end of the Pátli Dun in the Garhwal Division of the Western Circle, United Provinces. The Pátli Dun is a flat open plain bordering the Ramganga from about eight miles above Dhikálá down to Boxar and is surrounded with sal forests."

EFFECTS OF THE EARTHQUAKE OF APRIL 1905 IN FATEHPUR RANGE, KUMAUN FOREST DIVISION, CENTRAL CIRCLE.

M. S. RAWAT
FOREST RANGER, KUMAUN DIVISION.

Though the effects of the earthquake which occurred on the 4th April 1905 have been on the whole alarming, yet it is an ill-wind that blows no one any good, and the shock has not been without benefit to some people.

There is a place named Chaunsila, 12 miles from Naini Tal. Here the inhabitants annually incurred great difficulties in procuring a supply of water for drinking and other purposes. Every year at the close of the winter season the water in the stream became less and less every day until by the beginning of May not a drop was to be found for two miles in each direction. Owing to this the people of some two or three villages yearly suffered great trouble and calamity, and it was due to this want of water that the Forest Rest-house was erected at Fatehpur instead of being built at Chaunsila.

This year whilst the rest-house was being put up at Fatehpur suddenly the great earthquake of 4th April 1905 occurred, and the shock removed the trouble both of the inhabitants and of the weary travellers who, marching through this area in the summer, could procure no water to quench their thirst for eight long miles. From the date of the occurrence of the earthquake a large amount of water has been flowing throughout the whole of the dry season.

Owing to the same cause the volume of water in three streams, *i.e.*, Deigaon Sot (Dechauri Range), Tilaur Sot and the Nehal (Fatehpur Range), has been increased to about three times their original supply. I have been watching this increased supply throughout the hot weather, and I have hopes that it will continue permanently.

NAINI TAL, 31st July 1905.

CORRESPONDENCE.

THE IMPROVEMENT OF FOREST GROWTH IN BURMA.

A SUGGESTION.

Forest Officers, especially in Burma, are frequently reproached for devoting too little attention to operations having for their object the improvement of the existing growing stock. The reason of this neglect is of course the scarcity of trained men.

Could not something be effected through the agency of those officers who are annually placed on girdling duty? In selecting, say, 5,000 teak trees, the girdling officer covers a large tract of country. If he were directed to carry out improvement fellings as he goes along, he would indeed be longer occupied, but the extra time would be well spent. At the same time a climber-cutting party under one or more foresters or guards should follow in his tracks in areas where the teak is infested with those pests.

A girdling officer, after his day's selection is over, is expected to examine 20 per cent of the girdled trees to assure himself that they will actually die. He could at the same time without extra

exertion see whether climber-cutting had been satisfactorily carried out.

Something might also be done to improve the growing stock when working plans are in progress in any division. In any case, when an area is being closely examined by a trained man for any purpose whatsoever, the cause of improvement fellings should be borne in mind, and his services utilised to the utmost.

H. K.

GIRDLING OF MISCELLANEOUS TREES IN SAL FORESTS.

The following additions to the results given by Mr. Channer in the July edition of the *Indian Forester* may be noted for the sal forests of the Duars:—

A species which dies when lightly girdled—

Mallata Macaranga denticulata.

Species which do not die unless girdled heavily and the girdling renewed annually—

Simal Bombax malabaricum.

Patmoro Litsæa semecarpifolia.

Mainakat Tetrameles nudiflora.

What the final results of girdling are is often difficult to ascertain as heavily girdled trees are often blown down by storms. A *patmoro* in my compound of eighteen inches diameter, lopped and girdled six inches deep all round, leaving only a six inch diameter of wood in the centre, lived for over two years and has thrown out coppice shoots which are still vigorous though the main stem is now dead.

F. T.

THE VALUE OF BURNT ASHES AS AN AID TO GERMINATION.

I should like to call attention to the report for 1903-04 on the Dumraon Experimental Farm. In this it will be seen that, despite the loss of nitrogen, the ashes from burnt cowdung produced better crops of paddy than any other manure—it was not so good

for sugarcane, but the fact that it was so suitable to one crop is at least a support to the theory of those who say that the burnt ashes from a forest fire are more useful for germination than the unburnt decomposed leaves.

MAYMYO :

17th July 1905.

H. CARTER.

ON CERTAIN IMPORTANT FOREST QUESTIONS.

I have been much interested by the correspondence on Certain Important Forest Questions, and am encouraged thereby to make a suggestion. It is by no means rare for men in this country to take up some hobby such as local languages, religion, botany, or shooting. This phenomenon must be familiar to all of us and is seen in the case of the Forest Officer at least as often as in the case of other officials. That Government does not take advantage of this tendency is to be regretted. I think there will be no one brave enough to affirm that the present condition of the Forest Department with regard to quality and quantity of natural scientific talent is entirely satisfactory. I suggest that the precedent of the Army be followed. The Military Officer is allowed to go up for examination in special subjects such as signalling, transport, veterinary science, etc., and on qualifying is distinguished by a special mark against his name in the Army List; we Forest Officers in a similar manner should be able to go up before an annual board for examination in botany, geology, entomology, survey, and perhaps other subjects, and on qualifying be distinguished in the Civil List; a man to be able to go up for examination only after having been permanently appointed Deputy Conservator, and only in one subject at a time. A reward of Rs. 500 should be offered for qualifying in any one of these subjects, and the standard should be high so as to ensure a thorough knowledge of the groundwork and simpler parts of the subject, while considerable detailed knowledge of the science as applied locally might be reasonably expected. The passing

of "Higher Proficiency" in the local language should be held equal to passing in any one of the special subjects. Moreover, I suggest that the first and perhaps the second grade of Deputy Conservators be barred to all who have not qualified in at least one of these subjects, and the rank of Conservator to all who have not qualified in at least two. In lower grades consideration might be shown to men who had passed and less attention paid to seniority. These conditions should not be applied at once, but enforced only on those coming out later while optional for those now in the service.*

Then I think we should hear less of "not a forester, only a botanist," "unscientific foresters," "worrying scientific bureaux," "quasi-commercial department," and so on. Though that the department can perhaps be better described as more commercial than quasi (if by that modification it was intended to include scientific abilities and everything by which the commercialism was to be diluted) is to some extent I think to be laid at the door of that Government which ordered us to be stigmatised by such an epithet, even in its modified form.

I have noticed that men come out quite keen to go in for a little science, but receiving little or no encouragement and finding their surroundings so different from those at home, they become slack.

For the first three or four years a man ought to be fully occupied in learning his work, but after some six or seven years I think there are many who are rather horrified at their ignorance of local nature and surroundings, and with a little encouragement these men would endeavour to study them. Once a man had passed his special examination, which he could do only after showing himself thoroughly competent for work in that subject on behalf of the Forest Department in this country, it is unlikely that he would give up the study at once. When the elements are once learnt, all these subjects are interesting, and men would continue work in their speciality. We should have a greater number of men with

* Present Assistant Conservators would in this case run the risk of being passed over by their juniors.—HON. ED.

scientific reputations and the value of the department as a whole would be considerably increased. All honour to those who under present conditions have shown their quality, but the majority of men rust out here; the ability is always, and the will often, present, but the incentive is at present only *amour-propre* or *esprit de corps*, much-vaunted terms and, as accessories, very useful but in general cases not to be compared with £ s.d.

I make my suggestion because such a scheme appears to me to be one which both from an economic and scientific point of view would have great results. To reward a man for special ability and to encourage merit is I have read a maxim in America, and I think we should do more in that way.

I have the fullest sympathy at the discouragement of men freshly out from home, but the idea that "an average, hard-working, fairly 'cute sort of chap'" can run a Forest Division should be destroyed. This is the sort of principle imbibed at schools and colleges owing to the modern worship of games, and is one result of the Indian Civil Service examination by which men are picked for their brains alone, local knowledge and experience being supposed to do the rest. This idea, possibly excellent in the case of the I. C. S., permeates the Indian services and should be eradicated, at any rate from that highly specialised department, the Imperial Forest Service.

BURMA.

'INEFFICIENT.'

FIRE PROTECTION IN THE TEAK FORESTS OF BURMA.

I feel called upon to offer one or two remarks on the letters of Messrs. Fisher and Oliver on this subject in the July number of the *Indian Forester*. First as regards Mr. Fisher's recommendation that cleanings of bamboos and inferior species should be made in teak areas. These *are*, as a matter of fact, regularly made in the Tharrawaddy Division as far as time and staff permit. There are some who deprecate the cutting of bamboos over young teak on the ground that the cost is excessive. Undoubtedly the

cost is high, but I certainly hold with those who advocate the cutting of bamboos, within limits, over teak poles and saplings, as the observed results on areas so treated are markedly beneficial (for example, in the Konbilin reserve about half a mile east of Nyaungbinzin and in compartment 19 of the same reserve). But how many Forest Officers in Burma would wish that such an operation could be aptly compared to a cleaning in an oak and beech forest, or in a deodar and blue pine forest. Unfortunately a cleaning of bamboos requires to be repeated at short intervals, and each cleaning is vastly more laborious and costly than a cleaning of blue pine over deodar. In natural forest these cleanings are usually carried out during improvement fellings, while in plantations they are carried out every alternate year, under a regular scheme, by gangs of coolies under a forester or forest guard. The scarcity of labour in this case is perhaps a more serious consideration than the want of trained rangers, as the operation is one which any intelligent forester or guard can learn in a short time, while the enormous areas with which we have to deal would require a supply of trained rangers beyond anything we could hope for even if it were possible to obtain the requisite labour. Such cleanings in fire-protected moist mixed forest have never been observed by me to stimulate the natural reproduction of teak, but they are invaluable in freeing poles and saplings.

The point, however, which I wished to bring out in my letter in the March number is this, that if we continue our present policy of uninterrupted fire-protection of the type of teak forest known as "moist mixed," we shall in course of time cease to have any need for cleanings in natural forest, for we shall have no teak saplings and poles to free, however diligently we may have carried out cleanings. The areas alluded to above in Konbilin reserve have a plentiful supply of teak poles and saplings, as fire-protection was introduced in these areas only some three or four years ago, and the teak came up before it was introduced.

As regards Mr. Oliver's letter, it would certainly have made the information more complete had I enumerated *all* the trees on

the areas. This was not done as my time, when the enumerations were made, was limited. I have now written to Mr. S. Carr, who is at present in charge of the Tharrawaddy Division, to ask him if he will be so good as to enumerate the larger sized teak trees as well as all trees of other kinds on the two areas, and publish the figures in the *Indian Forester*. The enumerated plots have been mapped out.

The "undergrowth of small bamboos" does not consist of seedlings, nor is it confined to *Tinwa*. It is a fact which has, I believe, been noticed by many officers that in bamboo areas, at any rate of *Kyathaungwa* and *Tinwa*, which have been fire-protected for a long time, an undergrowth of smaller sized bamboos of the same species tends to form. The precise mode of origin of this undergrowth, and its connection with the older bamboos, I have not ascertained. As it is now several years since Mr. Oliver left Burma, this peculiarity had evidently not commenced to show itself in a marked way in his time; at all events Sir D. Brandis informs me that it was unknown in his day.

Mr. Oliver's inference that the composition of the bamboo crop on the two areas differs considerably will hardly hold, as the areas were specially selected with a view to obtaining two pieces of forest as nearly similar in type as possible, special stress being laid on the similarity of the bamboo crops on the two areas. The fire-protected area has been exceptionally heavily worked over for bamboos for many years past; in other words, it has been regularly cleaned by the bamboo cutters in a more complete manner than we can ordinarily hope to accomplish by our usual cleanings in natural forest.

DEHRA DUN :

R. S. TROUP.

12th August 1905.

[This correspondence is now closed. We shall, however, be delighted to publish all notes and articles detailing the results and records of actual experiments and countings, &c., made in the forests with the object of shedding further light upon this vexed question.—HON. ED.]

REVIEWS AND TRANSLATIONS.

THE MANUAL OF ARBORICULTURE OF THE UNITED PROVINCES, 1905.

We have perused this extremely useful little book with great interest, and are of opinion that the preparation and issue of such manuals mark a reawakening or revival of interest in this important subject. In our last number we drew attention to the recent Government Resolution upon this matter. This Resolution embodied a short review of the present position of the different Local Governments with reference to the planting operations upon the old and new road systems of their charges and suggested the lines of the policy the Government of India wished to see followed in the future.

The Manual before us is divided into a dozen chapters, which we will shortly consider in detail.

Chapter I deals with administration and control. We note that the responsibility for and control of arboriculture on provincial roads rests with the Public Works Department, except in cases where arboriculture was previously in the hands of Municipal or Cantonment authorities.

The objects to be attained, states the Manual, are—

- (1) Provision of shade for travellers.
- (2) Addition to the food supply of the people.
- (3) Provision of a fodder reserve in famine.
- (4) Securing as large an annual income as possible.
- (5) Improvement of the landscape.

These objects are stated in the order of their importance.

Chapter II deals with the preparation and carrying out of working plans. These plans are drawn up in consultation with the Director and are made for five-year periods, the plans being submitted to the Director two years previous to the expiry of the old one. The plans provide for the maintenance of all avenues on which the trees are not yet established, the balance of the

available grant being allocated to extending avenues or filling gaps in existing avenues. In order to draw up a plan it is necessary to know the annual grant, the cost of maintaining a young avenue the cost of planting a mile and maintaining it for the first year, and the number of years for which young trees of various kinds require irrigation and protection. In choosing the roads for planting up various questions have to be considered, such as the amount of traffic, the suitability of the soil and the ease of supervision. The more concentrated the work the better will be the results attained. The Manual rather favours the extension of new avenues than expenditure on the filling up of gaps in existing ones, especially where these latter are old.

With reference to the species of tree the planting of simal, siris, tun, nim-chameli and kachnar has been definitely condemned as also has the Millingtonia. On the subject of mixed avenues we read that as far as possible different kinds of trees should not be mixed up in the same length of avenues, the reason given being that some grow faster than others. This may be the case, but a mixed avenue is a far safer thing to plant and generally much handsomer than a pure one. In Quetta pure avenues have been extensively planted. They are now suffering severely from the attacks of a boring beetle, who under conditions so favourable has increased in enormous numbers. The casuarina pest *Arbela tetraonis*, of Madras lives upon the bark of several avenue trees* in that Presidency, and would undoubtedly commit great havoc in pure avenues of these species. With the experience of what damage such insects can commit we would never, or only very rarely in certain well-considered cases, advocate the planting of pure avenues.

Chapter III deals with the formation, tending and up-keep of nurseries, and Chapter IV with planting out. The rules and recommendations laid down for guidance in these two operations are quite in accordance with present accepted methods.

Chapter V considers the important question of maintenance and protection of the young plants. It is pointed out that a tree may be destroyed by ordinary traffic (presumably this includes

* *Vide p. 14 of this volume.*

wilful destruction by human beings) or by animals grazing or passing along the road. Various forms of tree guards are advocated, the adoption of any one of which must, it is stated, be left to the circumstances of the locality. The guard may be iron, wooden, brick, live hedges, thorns, mud walls or trenches. An ingenious but rather elaborate one consists of a low bank surmounted by babul thorns with a ditch on its outer side. This is stated to form a most effective protection.

Chapter VI deals with irrigation or the watering of the young plants, and although it is stated that no general rule can be laid down in ordinary cases, a young tree requires irrigation for the first three years after planting out, the amount of water varying of course with the season of the year. If existing canals or wells are available, the matter is simple. Otherwise wells must be sunk to provide the necessary water. The method advocated as the most effective one for watering a tree is to keep a full ghara, made of ordinary porous earthenware, buried close to the roots and having its neck level with the surface of the ground ; the side of the tree away from the roots should be painted with coal tar to prevent the water escaping in that direction. On the root side it soaks slowly through. The advantage of the ghara system is that a glance at the gharas will show whether the mali has been neglecting his work.

Chapter VII deals with miscellaneous items of maintenance such as (1) protection from frost by fixing thatching grass round the trees, (2) straightening young trees by attaching them firmly to a stout post, (3) replacing failures. One of the most important measures of all is alluded to here, *i.e.*, the termination of maintenance. It is laid down that when the period of maintenance provided by the plan is approaching its close, each length of avenue should be carefully inspected to see whether the trees can be safely left to themselves. An inspection of many young avenues all over the country will disclose how extremely important this inspection is. The whole of the expenditure may be easily entirely lost by leaving an avenue to itself too early in its career, even though the working plan prescribes that it should be so left, and on this

subject the remarks as to the removal, we would add the replacement also, of tree guards are very appropriate. It is laid down that the guards should not be removed until the lower branches of the trees are sufficiently high to be out of reach of cattle and goats. This is excellent, but we see no mention here of the replacement of the tree guards, and yet it is a very common thing to see broken down or overthrown tree guards, the young plant, if not already dying or dead, in constant danger of being browsed down by animals or broken down by the intentional or otherwise carelessness of human beings.

Chapter VIII deals with pruning, lopping and felling and the care of mature avenues. We welcome the order that the pruning of young trees should be prohibited, since where it may be beneficial can only be recognised by the trained eye, and if such is not available the safer course is not to prune at all. We cannot say that we quite agree *in toto* with the remarks on the subject of lopping. It is stated that lopping may be required to train a tree into proper shape, to remove branches which, hanging too close to the thoroughfare, interfere with traffic or in order to prevent one tree encroaching on another and impeding its growth. It is stated that this is necessary only when the trees have been planted too close together (in such circumstances it would seem to be better to remove one of the trees entirely) or when different trees have been planted in juxtaposition, having a different rate of growth. It is to avoid this latter, *i.e.*, to avoid one tree growing faster than its next-door neighbour, that the planting of pure avenues is advocated. The risks from the attacks of bark-boring and wood-boring insects are so great in India that we are of opinion that it would be preferable to lop than to plant pure avenues. We are glad to note that it is laid down that lopping, where it must be done, should be done flush with the trunk in either February or September and the wound tarred over. Felling, it is held, is only necessary when the trees are too crowded or when they are obviously dying. If young avenues are properly planted, a time will probably come when it will be necessary to remove some of the young trees, *i.e.*, those which have become

dominated and suppressed by the greater development of their neighbours. On the subject of dying trees a report should always be called for as to the reason of death. The writer has noticed in many parts of India, and especially in the case of pure avenues, that the trees are at times infested with bark-eating and wood-boring insects. Such insects if left alone in a pure avenue gradually kill out the trees, spreading from a dying one, which they have killed in the course of perhaps several years' attacks, to adjacent uninfested trees which in their turn are killed off. The avenue is thus gradually decimated without the real cause having ever been brought to light. Such trees when they have been marked should be felled when it has been ascertained that they are full of the eggs or grubs and *before* the mature insects issue to lay fresh eggs in adjacent trees. Such fellings will thus be most beneficial to the avenues; at the same time a careful watch should be kept for any freshly-infested trees, which should be at once removed.

It is laid down that the avenues near towns should be carefully watched to see that the trees are not lopped or stripped of their leaves for fodder by camel drivers and goat herds, a far too common sight in many parts. We remember to have quite recently seen a young avenue on a hot road near Huldwani upon which some twenty camels were contentedly browsing, they being aided in this occupation by the camel men reaching down or cutting down branches for them.

Chapter IX deals with the realisation of income. The sources of income are (1) sale of fallen trees, (2) sale of felled trees, (3) sale of loppings, (4) sale of annual produce of the trees, (5) sale of roadside grass. Trees to be felled should be sold standing and felled according to the rules laid down; lopping is never to be done by the purchaser but by the avenue staff. The grass is sold for the benefit of arboriculture. We think that it should be laid down that the sale of all grass on avenues of five years and under should be prohibited entirely, since the risk the young trees run is out of all proportion to the profits realised.

Chapter X deals with planting by private persons. Whilst every encouragement should be given to this it is held that no

private person should be allowed to plant on public roads without obtaining the written permission of the Chairman of the District Board, and certain conditions are laid down. An excellent one is that the trees will be the property of the person who plants them and his successors, but he will have to obtain permission to fell and lop. He will, however, be entitled to the fruit and dry wood. The planter when the trees are established will be given a *sanad* declaring his ownership.

Chapter XI provides that a register of all planted trees should be kept up, and Chapter XII deals with the planting of groves for encampments, especially on the roads where there is a large pilgrim traffic. Endeavours should always be made to plant groves on barren roads where the soil is of such a nature that it is impossible to hope to obtain avenues.

A few appendices showing the forms which have to be kept up in connection with arboriculture bring this most interesting little Manual to a close. If there is anything wanting to make it complete it is the point as to whether more use might not be made of the Forest Officer in districts where there are such employed. We would suggest that since such officers have in the course of their duties to travel over a number of roads planted with avenues they might be requested to report on the state of the trees on the roads they may have travelled along in the course of their annual tours. We think that much good would ensue from such a practice.

FOREST ADMINISTRATION IN THE ANDAMANS, 1903-04.

A considerable amount of very interesting work was got through in the Andamans during the year under review, and as a result the report before us proves one of exceeding interest.

At present no working plans exist for the forest in the Islands, but with a view to the drafting of preliminary working-plan reports an exploration of the South and Middle Andamans and of the adjacent islands was undertaken in order to ascertain as far as possible the stock of mature Padouk (*Pterocarpus dalbergioides*) available. This work was carried out by Mr. C. G. Rogers over the following areas:—Baratang Island and the small islands to the east of it;

the portions of the South Andaman not previously explored ; the Labyrinth Islands ; Rutland Island ; the islands in Ritchie's Archipelago except Sir Hugh Rose and Neill ; the south-east corner of the Middle Andaman behind Long Island. We understand that the information obtained by Mr. Rogers will form the subject of a special report, which, it is hoped, will materially assist in bringing these forests under systematic working.

By far the largest portion of the sum expended on communications and buildings was incurred on tramways. The Wimberly Gunj permanent steam track is now $2\frac{1}{2}$ miles long, having about $4\frac{1}{2}$ miles (of which three are upon the level) to be completed. Some five miles of temporary tram line were also laid down making a length in all of $18\frac{1}{4}$ miles.

A canal 2,068 ft. long, 16 ft. wide and 5 ft. deep was dug between two creeks leading into Port Meadows and the Middle Straits respectively. The importance of this canal, when taken in conjunction with the similar channel constructed from Kutara into Port Meadows, can scarcely be over-estimated, through communication by water suitable for rafting having been thereby established between the Middle Andaman and Port Blair.

A fact which has recently been brought to light and one whose discovery in relation to the future well-being and up-keep of the forests is of the highest importance is that natural reproduction of Padouk and the other more valuable species is remarkably scarce. Seedlings and saplings of less important species such as Gorjan (*Dipterocarpus*), white Chuglam (*Terminalia biatata*) and white Bombway (*T. procera*) are said to be fairly numerous in many places. The absence of Padouk saplings and seedlings has been incontestably proved as a party of ten men were kept at work for some time, in pursuance of a suggestion made by the Government of India, searching for natural regeneration of this tree with a view to freeing it from surrounding growth. The experiment was discontinued owing to the absence of young Padouk growth. It has been decided to regenerate Padouk areas by the method of taungya plantations, and in accordance with this decision one hundred acres of mixed forest between Wimberly

Gunj and Goplakabang were cleared of vegetation (by cutting and burning) and sown 6'×6' with Padouk. The seed has germinated well and the plantation promises to be a success.

In addition to these Padouk sowings 118 acres of mangrove swamp were sown up 4'×4' with mangroves, and blanks in other plantations filled up over an area of 56 acres. These mangrove plantations are said to have proved cheap as well as successful. Rupees 4 per acre is sufficient to completely re-stock swampy areas including the cost of collection of seed and other contingent expenses. Some experimental sowings of Gorjan Dipterocarpus sp.) were also made with a view to ascertain the best conditions for their successful germination and subsequent growth.

We read that no system has yet been introduced into the working of the Andamans forests. In the more remote forests Padouk alone is extracted, all mature trees being removed wherever found. In the intermediate areas all mature timber trees of marketable kinds are removed as a demand arises. In the forests round Port Blair from which all the Padouk has long since been cut out (the report does not tell us why during this cutting the total absence of Padouk regeneration was not noticed and reported) fuel fellings are being carried on. In these areas all Gorjan trees, which appear to comprise half of the upper storey, are being left as seed bearers or standards. The extraction of minor produce such as bamboos, canes and thatching leaves is done by departmental agency or by purchasers, these articles being cut out wherever found. Gorjan trees are tapped for the oil departmentally, only trees above six feet being so treated. Mangrove bark is collected for tanning and dying, but only outside the Settlement fuel limit.

As regards the timber and fuel practically the whole of it is exploited by departmental agency. The round logs are dragged by elephants to the nearest creek or to the sea face, where they are made up into rafts consisting of from 40—120 logs and towed into Port Blair or to one of the two tramways. Some 5,171 logs weighing 5,280 tons were thus handled during the year. In order to facilitate the rafting operations in the open sea a steam timber boat is under construction. For this boat a sum of Rs. 1,13,000

has been sanctioned, and the report states that it was hoped that she would be ready by June 1905. She is expected to carry about 200 logs weighing a ton each.

Four hundred and fifty-two thousand six hundred and twenty-two cubic feet or 9,052 tons of timber were extracted during the year, the cost of extraction being Rs. 12-13 per ton as compared to Rs. 12-8 for 8,445 tons the previous year. The slight increase is due to the longer lead.

The following table compiled from Forms Nos. 57 and 58 gives the outturn of the reserved and unclassed forests according to the agency of exploitation, and compares the yield with that of 1902-03 :—

Agency of exploitation.	RESERVED FORESTS.		PROTECTED FORESTS.		UNCLASSED FORESTS.		TOTAL.	
	1903-04.	1902-03.	1903-04.	1902-03.	1903-04.	1902-03.	1903-04.	1902-03.
	1	2	3	4	5	6	7	8
	c. ft. solid.	c. ft. solid.	c. ft. solid.	c. ft. solid.	c. ft. solid.	c. ft. solid.	c. ft. solid.	c. ft. solid.
Government ...	272,941	298,466	...	...	179,681	123,774	452,622	422,240
Purchasers ...	7,023	5,491	...	...	11,625	10,066	18,648	15,557
Free Grantees	...	8,525	...	...	27,510	17,050	27,510	25,575
District Officers.	2,556	12,532	...	...	57,335	60,013	59,891	72,545
TOTAL ..	282,520	325,014	...	...	276,151	210,903	558,671	535,917
Difference in favour of + or against (-) 1903-04.	-42,494		-		+65,248		+22,754	

The total outturn of timber in the rough is 22,754 cubic feet solid more than last year.

There was a substantial increase in the exploitation of Padouk. 3,712 trees being felled as compared with 2,778 of the previous year. This was necessary in order to supply 12,000 tons to be delivered to Messrs. Gillanders, Arbuthnot & Co., on their three years' contract.

The saw mill appears to have worked at full pressure during the year. The following table shows in detail how the outturn of the mill was disposed of :—

YEAR.	SENT TO CALCUTTA FOR TRANSMISSION TO LONDON.						SALES AT PORT BLAIR.					
	PADOUK.			OTHER TIMBER.			TO SETTLEMENT.			TO GENERAL PUBLIC.		
	To meet 2nd Contract for 1,600 tons, dated 21st May 1902.											
	Sqs. c. ft.	Slabs. c. ft.	Total. c. ft.	Sqs. c. ft.	Slabs. c. ft.	Total. c. ft.	Padouk. c. ft.	Others. c. ft.	Total. c. ft.	Padouk. c. ft.	Others. c. ft.	Total. c. ft.
1903-04 ...	20,147	10,785	30,932	1,845	6,111	7,956	27,090	28,692	55,782	5,243	3,981	9,224
1902-03 ..	35,088	13,882	43,870	1,668	2,074	3,742	44,188	22,854	67,042	5,888	2,388	8,276

YEAR.	SALES IN INDIA AND BURMA.											
	CALCUTTA.						RANGOON.					
	Messrs. Gillanders, Arbuthnot & Co.	Gladstone, & Co.	Wylie & Co.	Jessop & Co.	Turner, Morrison & Co.	Stewart & Co.	Captain Pently.	Master of the Mint.	Superintendent, Ali- Pore Jail.	Managing Agent, Calcutta Tramways Company	Municipal Engineer.	Agency Division, Pegu Circle.
	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.	c. ft.
1903-04 ...	9,968	4,301	4,146	710	655	13	287	1,260	...	469	...	125,712
1902-03 ..	6,6	...	...	...	...	...	...	750	2,206	...	847	133,419

The second contract for 1,600 tons mill sawn Padouk squares was completed during February 1904, and the third contract for supplying 12,000 tons Padouk logs was taken in hand during the year.

To improve the sale of Andaman timber, 21,809 cubic feet, or 436 tons, was sent to Calcutta and Rangoon to the firms mentioned above, and to Government Departments, as compared with 4,479 cubic feet, or 90 tons, in 1902-03.

The fifty thousand Padouk and Pyimma shingles sent to Rangoon last year for experimental sale did not prove a success. The shingles were lying in charge of the Deputy Conservator of Forests, Depôt and Agency Division, unsold for some time, and at last were disposed of by public auction.

The revenue and expenditure for the year 1903-04 compares as follows with that of the previous year :—

Year.	FINANCIAL YEAR.			FOREST YEAR.		
	Receipts.	Charges.	Surplus.	Receipts.	Charges.	Surplus.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1903-04 ...	4,32,381	2,66,124	1,66,257	4,77,894	2,89,150	1,88,744
1902-03 ...	3,26,035	2,81,702	44,333	3,38,419	2,77,510	60,909
Difference ...	+1,06,346	-15,578	+1,21,924	+1,39,475	+11,640	+1,27,835

The increase of Rs. 1,30,379 in timber removed by Government Agency is due almost entirely to the larger removals of Padouk owing to the enterprise shown in attracting Calcutta firms to the advantages of a trade in Andamans timber. The energy shown by Mr. Rogers in this as well as in his explorations of some of the islands has done much to attract attention to the fine Andamans forests and cannot fail to have excellent results in the future.

The report is written by Mr. B. B. Osmaston, who has replaced Mr. Rogers (now on furlough) in charge of the Division. The latter was, however, held by Mr. Rogers throughout the year. The Division was inspected by Mr. F. B. Manson, Conservator, Tenasserim Circle, during the year.

There is a remark in the report that although a staff of 39 elephants and 32 buffaloes are on the stock lists, the officer in

charge of the Andamans is still without the services of a qualified veterinary officer, although rinderpest has been very prevalent in the Settlement. With the recent experience of Madras and Mysore fresh in the memory the urgency of the case would not seem to have been too strongly pleaded by the Divisional Officer.

Our task is done, but in laying down our pen we would congratulate Mr. Osmaston on the extreme interest of his report and on the varied and entertaining nature of his work in the lovely Islands.

FORESTRY IN INDO-CHINA.*

A LESSON—FIVE YEARS AGAINST FIFTY.

"No sooner had the French troops occupied Cochin China than the Admirals recognised the need to establish a forest machinery capable of protecting the colonial forests from devastation. A little later, Cambodia, Annam and Tonquin came under protectorate, Laos became French, and in these provinces also were issued consecutive decrees and orders all aiming at the same object, the utmost possible protection of present forest wealth in order to guarantee the safety of the future. A few years later, the early orders were found insufficient. The forests continued to be looted and threatened to disappear unless proper steps were taken. The water system of the country, indissolubly connected with the forests, began to raise anxiety for its future permanence, and, in short, all parts of the country were asking and advising that something be done. In 1899 the Ministry of Colonies despatched M. Roger Ducamp, an Inspector of the French Forest Service, to enquire into the state of the forest question in Annam and Tonquin. In consequence of this mission the Governor-General, M. Doumer, in 1900 submitted to the President of the Republic a draft law for the creation of the Indo-China Forest Service. This law, signed in 1901, made the new department part of the Ministry of Agriculture, Forests and Commerce."

* Being a free translation by F. G. of the opening paragraphs of an article by M. R. Lambert in *La Dépêche Coloniale* of Paris.

"This present regulation will permit the gradual stoppage of devastation. Doubtless details will require modification, but they already suffice for the main principle, the preservation of the forest and its better working. The action of the new Forest Service must on no account be hampered, and it hopes even to escape the unjust and undeserved reproaches that are so generally flung at the heads of those whose lot it is to initiate the curbing of abuses."

"The grandeur of the part played by forests in the scheme of creation tends to render the forester, with his close appreciation of nature, rather a fanatic; but the position of one who has to invent and begin working a new regulation is not enviable. Let those who consider him a meddlesome nuisance turn to France and other civilised countries; let them ask of the Vosges and Jura, and Savoy villages what produces their prosperity. The reply would be unanimous—'the forest.' On the other hand, let them ask the valleys of Spain or Algeria why their dry sandy river beds come down once or twice a year bringing muddy destruction and sometimes death. The answer will be 'Deforestation.' The silting-up of the Loire is due to the recent destruction of forests in the 'plateau central.' The terrible floods that have afflicted America of recent years are due to the immense forest fires and to the excessive grazing of sheep. Let the detractors of forests read the history of the Hautes et Basses Alpes. In 1865 the ignorant mountaineer used to turn out at night and destroy the forest plantations. Now there is nothing too good for him to say of those who have saved the valley and the plain by helping nature to recover her own. Stop the dry torrents in the miserable devastated valleys of the Mediterranean slopes, and wealth will return with the growth of the white coal. In Indo-China, the Donaï and the Saïgon rivers have well-wooded basins and are navigable right up to their rapids. The Red River and the Mekong are silting up like the Loire, and boats run aground, because the greater part of their basins is denuded. These are but examples. The forester has raised the alarm and been supported. The day of destruction is past. The arms of the forester are arms of peace which will ere long bring wealth and prosperity to French Indo-China."

CURRENT LITERATURE.

MR. GIFFORD PINCHOT, Forester, United States, has published a second part of his *Primer of Forestry*. This little volume deals with the practice of forestry work in the woods and the relation of the forest to weather and streams. In the first chapter the author considers the yield of a forest and the various sylvicultural systems in the second methods of felling and transporting timber from the forest, its conversion in the mill, and planting up. Chapter III deals with the effects of forests on climate and rainfall, and Chapter IV with forestry abroad and at Home. This chapter in its simple conciseness should prove of interest to all interested in Forestry. When we say that the little primer (it is of pocket book size 6" x 5") contains no less than eighteen plates and forty-seven smaller illustrations, mostly beautifully clear and excellently chosen, it will be understood that the little work possesses a high value.

The AGRICULTURAL BULLETIN of the Straits and Federated Malay States (June) contains an interesting article on fibres, species of *Artocarpus*, *Ficus*, *Hibiscus*, *Thespesia*, *Macaranga*, *Mallotus*, *Calotropis*, &c., being considered. The number chiefly contains notes and articles on Rubber including one on 'Coagulating Rambong,' by E. S. Carr, Conservator, Assam. Tapping and washing rubber, rubber machines and rubber seed are also dealt with.

The BOTANICAL GAZETTE. (July) has articles on Undescribed Plants from Guatemala and other Central American Republics, by J. D. Smith, and an interesting article by T. C. Frye and Eleanor B. Blodgett entitled 'A Contribution to the Life-history of *Apocynum androsaemifolium*.' According to the authors not one of the Apocynaceæ, a family of about 1,000 species, has ever been studied carefully in reference to the minute morphology of the flower. The results of the authors' investigations into this latter are detailed in their paper.

L. M. Snow of the Hull Botanical Laboratory (America) contributes an extremely instructive article on The Development of Root Hairs. He describes his paper as an endeavour to add some facts and suggestions as to the causes for the production of root hairs, variations in their structure not being considered.

In No. 4 of the CIRCULARS and AGRICULTURAL JOURNAL of the Royal Botanic Gardens, Ceylon (July), Mr. H. F. Macmillan describes some ornamental climbers and creepers of the Island. Amongst fine flowering climbers for the low country he recommends *Allamanda cathartica* and *Hendersonii*, *Antigonon Guatemalensis*, *insigne* and *leptopus*, *Aristolochia elegans*, *hians*, *ridicula*, *Asparagus falcatus* and *racemosus*, *Bignonia magnifica*, *venusta*, *Bougainvillea glabra*, *spectabilis*, *Clerodendron Thompsonae*, *speciosum*, *Clitoria* and *ternatea*.

In BULLETIN NO. 55 of the U. S. BUREAU OF FORESTRY A. K. Chittenden considers the forest conditions of Northern New Hampshire. His conclusions may be summarised as follows :— Fire protection is essential if Northern New Hampshire is to be protected as a summer resort and a source of timber supply, and the organisation of a fire service is recommended. That conservative lumbering under the supervision of trained foresters would pay the large lumber and pulp companies operating in the area better than the present methods. That the proper management of woods belonging to farms is necessary and that planting up of denuded lands unsuitable for agriculture promised good returns. A Central State nursery should be established for the distribution of plants, and cut over areas in the mountains should be purchased for the formation of a forest reserve.

The Report of the BUREAU OF FORESTRY in the PHILIPPINE ISLANDS issued by its Chief is of very considerable interest in that it shows so plainly what tremendous economic progress can be made in forest work and forest science when a central scientific and economic guiding and advising Bureau exists. Both in America and in this new colony of theirs forestry has been initiated by the formation of a Forestry Bureau consisting of scientific experts who, each in his own line, looks at the forest first from its economic and secondly from its scientific aspects ; the sole object of each is to apply scientific methods to the problems which face him in order to obtain the greatest economic value from the forest. In spite of its infancy the United States have the right to be proud of its work in the Philippines. One of the most important

events of the year was the promulgation of the Forest Act for the betterment of the Forest Service. A number of forest stations have been formed throughout the Islands and their inspection arranged for by the inspecting staff. The difficulty at first experienced in obtaining men to work in the provinces is now said to be disappearing. A beginning has been made in conducting lumbering operations along rational forest lines. The Bureau measures up the logs before they leave the roll way, and thus ensures itself against loss by floods. Payment is taken on sawn timber plus 15 per cent. A system of regular examination by Forest Officers of all areas cut by licensees has been inaugurated, and this should do much to check waste. The report, as is the case with all American reports, is illustrated by a number of plates, which do not, however, come up to the high level usually found in this class of American publication. It is probable, however, that these reproductions were made in Manilla, which would account perhaps for their not being first class.

FORESTRY and IRRIGATION (June) has the usual number of popular articles on the value of forests to a nation, mostly well illustrated. From our readers' point of view, the article of chief interest will undoubtedly prove to be that on 'European Study for Foresters' by T. S. Woolsey, jr. The author, following in the footsteps of a brother officer of his, considers that four to five months is quite sufficient in Germany. He has a considerable number of remarks to make about an Indian tour, and whilst fully recognising its real value considers that its expense is against it. He writes "In scientific lines I consider the United States already equal to, if not ahead of, India." This is not pleasant reading, but we fear there is a strong element of truth in it. "For men anticipating practical rather than scientific work such a trip offers much. Certain commonsense principles pervade Indian forestry, and these will be of lasting value and of direct application in the United States. On the purely practical side Indian forestry is at present pre-eminent. The financial working of the forests is closely scrutinised by the Local Governments. Possibly the financial importance of forestry has been made to take too prominent

a place and has led in some cases to over-cutting." . . . "By a trip to India one learns the ordering of forest business on a large scale; you see the best fire protection in the world, practical sylviculture, the regulation of grazing, the danger and abuses of over-felling, natural reproduction over large areas; you learn the results of certain kinds of large scale working plans; you learn many things, most of which have direct application in the United States. Opposed to these is the amount of time and money spent in travel, danger to health" (we are of opinion that owing to insufficient information upon this head our criticiser is disposed to unduly magnify this danger) "and lack of available literature. It is almost impossible to secure copies of working plans for the reserves visited or in fact any publications similar to those which our Government distributes free for educational purposes." Three points stand out prominently in this open criticism of forestry in India—the want of a Forestry Bureau, the absence of Indian forestry literature, and the difficulty of obtaining copies of what little there is. Do not these criticisms strike home? We trust that ere long one and all will be things of the past; that a Forestry Bureau will be in being, and that its publications will be numerous and of a high order, and that they will be available for distribution on the same generous scale as are those of America.

SHIKAR, TRAVEL, AND NATURAL HISTORY NOTES

A COLLECTION OF SPORTING TROPHIES.

Quite a unique collection of sporting trophies has been recently on view at Woodcock Cottage, Ootacamund, the residence of Messrs. Gorden and Edward Hadfield, the sons of the late Colonel Hadfield, an Indian Military Officer, who, after retirement, settled on the hills and had the distinction conferred upon him of being made Honorary A.-D.-C. to His Excellency the Viceroy. The collection is artistically arranged in a special building constructed to receive them, and may be inspected with permission, readily obtained.

The late Colonel Hadfield was an ardent sportsman, who succeeded in imbuing his boys with the same sporting spirit. The trophies he secured during his lifetime, and those by his sons before 1882, were, from time to time, given away to friends, so that those now exhibited at Woodcock Cottage are the spoils of twenty years' shikar only, and prove how beautiful and varied game has always been on the hills, if only the sportsman knows how to go about to secure it. Every specimen in the collection can be obtained at the present day on the hills, or in the wooded plains of Southern India. Among the trophies given away was the mounted head of a record sambhar fired at on the slopes of Dadabet and struck in the horn. The shot stunned the quarry, which raced down hill, across the open ground attached to Stonehouse, now the Secretariat offices of the Madras Government, and fell exhausted in the swamp below Saling Cottage and St. Stephen's House, where it was despatched by its pursuers. That head is now on view in the Paris Museum.

Mounted on a shield, in the centre of the west wall of the building referred to, is the head of a Nilgiri tiger killed by Mr. G. Hadfield at Portimund, a picturesque Todah hamlet on the Kundah mountains. The animal measured 10 feet 4 inches as it lay. It was a regular hill tiger, judging from the length of its whiskers and its hairy coat, and had been wounded before, as a snider and a 12-bore spherical ball were cut out of it. The missile to which it succumbed was a .577. All round this trophy are grouped sambhar heads, the majority of which were shot on the plateau, and varying in size from 32 to 36 inches. The two tiger heads placed on a table to the right of the above were secured, one by Mr. G. Hadfield and the other by Mr. E. Hadfield, both at the Pykaru Falls, a locality where the largest Government cinchona estate is situated. Their owners were exceptionally fine animals and measured over 10 feet. The two on the left are those of a tigress and a tiger, one shot at the roadside station of Pykaru and the other at Peermund, a celebrated hunting tract, where these gentlemen own a shooting lease. Behind these heads, and partly concealed by a panther skin, is the head of a bull bison, almost a record. He was shot by Mr. G. Hadfield, in the Nilambur teak forest, of which at one time Mr.

Hadfield was Deputy Conservator in charge. The span between the horns as soon as the bison was shot was 46 inches, but, owing to shrinkage, it is now two inches less. All the other heads on the left are of cheetal (or spotted deer) bucks, also shot in the Nilambur teak forest. They average from 28 to 35 inches, and form an exceptionally good collection. At the bottom, on the same side, are heads of several bison bagged mostly on the Western Ghauts, and among these trophies interspersed are the head of a barking deer and of an ibex secured on the Kundah. Just over the mantelpiece on the south wall of the room are the heads of two black panthers, so rare on the Nilgiris, that few sportsman can boast of having killed one.

Horizontally along the same wall is stretched the skin of a boa constrictor, 16 feet in length, fairly common in the Western Ghauts during the rainy weather. When killed the snake had two cats inside. Its method of seizing its prey is as follows: It lays itself, in some cases, along the path frequented by game, looped in two or three places, which loops contract the moment the foot of an animal is placed inside; in other cases, the tail is coiled round the stem of a tree and the body hangs over the pathway, awaiting the approach of prey, that is immediately taken in a fatal embrace. On the right of the mantelpiece are several heads of spotted deer and sambhar, and below, on the floor, are the heads of a couple of bison, spanning between the horns 38 and 39 inches.

The floor of the room is covered with prepared skins of wild animals, killed by these sportsmen. The display is most unusual, and although the number seems great, it forms but a fraction of the entire collection.

The late Mr. Morey was favoured with an inspection, and declared the collection to be the largest and best preserved of any he had ever seen, affording evidence, he thought, that the game on the Nilgiris is both varied and undiminished, despite the vaticinations of those who persist in urging that a closer conservancy is necessary to preserve what is left.

EXTRACTS FROM OFFICIAL PAPERS.

OBITUARY.

WILLIAM T. BLANFORD, F.R.S., C.I.E., ETC.

By the death of Dr. W. T. Blanford in June last the Scientific Departments of India whose work brings them into contact with zoological and geological problems have suffered a severe loss—a loss which our readers would not wish the *Indian Forester* to pass over without notice. That Dr. Blanford's interest in the Forest Department was of the deepest is evidenced by the fact that his eldest son will join its ranks next cold weather as an Assistant Conservator in Burma. We had intended to give a short sketch of Dr. Blanford's career, but we feel that it would be impossible to better the excellent biography which, under the title of "A Great Indian Naturalist," appeared in the 20th July issue of the *Indian Field*. We accordingly reproduce this here with due acknowledgments to the Editor of that interesting periodical.

To every one interested in Indian zoology and Indian shikar the name of Blanford comes as a familiar household word; and it is therefore with great regret that we have to record the passing away of the great geologist and naturalist who bore that name. Born in London on 7th October 1832, William Thomas Blanford died in the Metropolis on the 23rd of June last, after a service of 27 years on the Geological Survey of India, followed by two-and-twenty years of married life in England. As he would have chosen to do, he died in harness, being at the time of his decease Treasurer of the Geological Society and also one of the Vice-Presidents of the Zoological Society of London; while he was engaged, so far as his strength permitted, on the volume dealing with land-shells for the *Fauna of British India*, and likewise with editing other volumes of that invaluable series. Those who had the privilege of his acquaintance had, however, during the past few months noted with sorrow the rapid bowing of the once erect form and the loss of the characteristic free and firm step; and were therefore not unprepared for the great change. The end came,

we believe, with comparative suddenness. For some time Dr. Blanford had suffered from gout and the fatal illness appears to have been pneumonia complicated with the former malady.

After completing his school education, young Blanford joined the Royal School of Mines in Jermyn Street, of which he soon became one of the most distinguished pupils, and he also studied practical Geology and Mineralogy at the Mining Academy of Freiberg, Saxony. The distinction with which he passed both these courses at once pointed him out as a promising candidate for a post on the Geological Survey of India, then at the commencement of its career; and he was accordingly recommended by the then Superintendent, Dr. Thomas Oldham, for an appointment, the recommendation being in due course accepted by the Indian Government. Blanford joined the Survey on 1st October 1855, and from that date till the 25th of April 1882, when he finally took sick leave to England and subsequently resigned his appointment, he worked unremittingly at his official duties. Not that the whole of his time was by any means spent in India, for, apart from ordinary leave and furlough, he was appointed in 1868 to accompany, as Naturalist, the expedition under Lord Napier of Magdala to Abyssinia, while in 1872 he was selected to act in the same capacity with the Seistan-Persian Boundary Commission under General Sir Frederic Goldsmid. For his services on the former expedition Blanford received the Abyssinian medal. His work on the natural history of the country is described in *Observations on the Geology and Zoology of Abyssinia*, published in 1870, and illustrated with a number of coloured plates of birds. Similarly his investigations into the natural history and geology of Persia are recorded in the second volume of *Eastern Persia*, which was published by Messrs. Macmillan in 1876, and contains a still larger number of coloured illustrations; this volume being from Blanford's own pen, supplemented by a number of interesting notes contributed by the late Sir O. B. St. John. The experience and extensive zoological knowledge gained during these two expeditions, coupled with his zoological work in India, doubtless stood Blanford in good stead in later years, and probably were

potent causes in inducing him to take up in real earnest the study of the geographical distribution of animals.

To refer in detail to his geological work in India would be out of place, and indeed impossible on this occasion. It may be mentioned, however, that during the early part of his career as a member of the Geological Survey he mapped and described the Talchir coal-field, in the course of which he directed special attention to the occurrence of what he believed to be iceborn boulders in the Talchir beds themselves—a conclusion which has been subsequently accepted by geologists in general. The geological age of the entire system of Indian freshwater rocks to which the name of Gondwanas is applied was also a subject in which he displayed keen interest, and which gave rise to a somewhat embittered controversy in which he came out victorious. During his later years in India the rocks of Sind occupied much of his attention and formed the subject of a volume in the *Memoirs* of the Indian Survey. He also made an excursion into the Bugti Hills, which resulted in the discovery of a deposit of fossil mammalian remains; the few specimens of these he was able to bring back proved of exceptional interest and importance.

On the retirement of Dr. T. Oldham from the head of the Geological Survey in 1876, the late Mr. H. B. Medlicott, on account of a slight seniority in service over his colleague, succeeded to the vacant post; Blanford, who now became Senior Deputy Superintendent, being rewarded for his meritorious services by a special increase of pay. The two colleagues (who, by the way, died within a few months of one another) almost immediately set to work upon the *Mammals of the Geology of India*, which will long remain as a monument to their memory.

During his Indian service Blanford was twice President of the Asiatic Society of Bengal (in 1878 and 1879); and in 1874 he was elected to the Fellowship of the Royal Society, the highest non-official scientific distinction an Englishman can receive. Throughout his Indian career Blanford had directed such time as could be spared from his official duties to the study of various sections of the modern fauna of the country, Indian birds and land-shells, and

next to these, perhaps, mammals, being his special favourites. And after his retirement from the Indian service the zoological side of geology together with zoology itself occupied the greater part of his attention, and produced some of his best work. In his capacity of President of the Geological Society of London he delivered in 1889 and 1890 two addresses dealing with the changes in the relative distribution of land and sea in past times and the influence on these on the distribution of animals and plants which can only be described as little short of epoch-making. These were followed later by a most valuable memoir on the distribution of animals in India and the zoological provinces into which that country might be divided, published in the *Philosophical Transactions*. For these efforts, in conjunction with his work in connection with the *Fauna of British India*, the Royal Society conferred upon Blanford in 1902 one of its two royal gold medals. Of the aforesaid *Fauna of British India* published under the direction of the Indian Government Blanford was the editor; and he himself wrote the well-known volume on mammals, as well as two out of the four on birds. Almost up to the time of his death he was engaged, as already mentioned, on the volume devoted to his beloved land-shells; a work for the completion of which it may be hoped an efficient successor will be found.*

It may be added that Dr. Blanford was President of the Geological Section of the British Association in 1884, and that he was also a Fellow of the Royal Geographical Society, and for some years President of the Malacological Society.† Quite recently he was made a C.I.E. (a distinction, by the way, none too high for a man of his ability and talents, especially when another was available), and he was likewise a Knight of the Italian Order of SSmm Maur. et Lazar. During the whole period of his residence

* Including the recently published first volume of the *Indian Butterflies* Col. C T. Bingham) 18 volumes of the Fauna have been published under the Editorship of Dr. Blanford. Other volumes in hand in addition to the shells are further volumes on the butterflies and *Rhynchota*, a volume on the *Cerambycidae* and another on the *Buprestidae*. — HON. ED.

† Dr. Blanford, as Vice-President of the Zoological Society of London presided at a meeting but shortly before his death

in England, after his retirement from the public service, Blanford was consulted by the Government of India with regard to the appointment of candidates for the Geological Survey, whenever vacancies occurred, and, we believe, also with regard to other scientific appointments in India.

Blanford, in a word, was universally recognised as one of the few men entitled to rank as an authority on Geology, Palæontology, and Zoology, to each of which branches of science he had largely contributed. It was this wide range of study that gave to Blanford's opinions and theories the weight they always bore in scientific circles, and rendered them in all cases so much more valuable than any based on merely upon one line of evidence. To Blanford we are largely, if not indeed mainly, indebted for the overthrow of the false theory as to the permanency of continents and ocean basins which at one time threatened to cramp and distort our views with regard to the past distribution of animal life on the globe. And it is to him that we are also indebted for important modifications in regard to the zoological provinces into which the map of the world may be divided.

His breadth of view made short work of the ultra refinements and minute subdivisions introduced by specialists into zoological classification ; and he was altogether intolerant of the methods adopted by Gray and his followers. Consequently, in all his works we find genera and species treated in a wide and comprehensive sense. Nowaday, there is a revolt against this method of treatment ; but Blanford was always confident that it would eventually hold its own against the hairsplitting of specialists who have no eye for anything beyond their own limited field of study. And we sincerely trust it may, even if it should lead to the adoption of two schemes of classification—one for the specialist, and one for the man of broader and more philosophical conceptions.

William Blanford was in truth a man of whom both his native land and his adopted country may well be proud ; and it will be long before we see his like again, for a kindlier nature, a truer and more trusty friend, and a better and keener sportsman, it would be hard indeed to find.

THE PREPARATION OF RUBBER AT MERGUI, TENASSERIM.

The following notes upon the preparation of rubber at the Mergui Plantations in Tenasserim have been kindly forwarded by the Inspector-General of Forests. They are extracts from a letter from the Conservator of Forests (Mr. F. B. Manson), Tenasserim Circle :—

The term "wet process" for the preparation of the rubber is used in contradistinction to the process of curing by hot air and smoke in Mr. Wickham's machine.

2. The wet process in use at Mergui Experimental Gardens is the simplest possible method and yields very clean rubber. The fluid latex strained, but without any admixture of chemicals but diluted with water, if too thick, is set to cream in soup-plates. The rubber particles, which are of lower specific gravity than sap, gum, etc., rise to the surface whilst the watery constituents of the latex and impurities sink. After about 24 hours or less the rubber forms a soft creamy white cake, which is removed by hand pressed, stamped with the plantation mark, washed and then placed on well ventilated racks under a shed to dry. I should mention that after the cakes of rubber are removed from the soup-plates the residual liquor, which is usually slightly milky, is collected along with the washings of the collecting cups in larger vessels, some clean water is added, if necessary, and the mixture stirred. After standing for 24 hours or so a certain quantity of rubber rises to the surface. This is carefully washed and dried, and is sold along with the scrap. I contemplate treating this quality of rubber eventually in a washing machine and exporting it in the form of sheet-rubber. Manufacturers, however, seem to be quite content with the "pancake" or biscuit rubber now sent from plantations.

The quantity of latex at present dealt with is inconsiderable, being derived only from the older trees in the Experimental Gardens. It is not sufficient to warrant the purchase of expensive machinery, but I am of opinion that some simple machinery and drying apparatus will be needed in a few years' time as all labour available will be required for collecting the latex. I have

accordingly made enquiries through the International Rubber Planters' Association, of which I have become a member, with a view to improving our present primitive methods of preparation and hastening the drying process. As this concerns our methods of preparation I beg leave to enclose a copy of my letter of enquiries, and to refer you for the sequel to the *India Rubber Journal* of the following dates :—

16th January, correspondence *re* Washing Mills.

13th February, page 169, "A Question for the Rubber Trade."

27th February, page 222, "Washed and Dried Rubber."

13th March, page 269.

It is possible that it may be found profitable to adopt the centrifugal separation of the rubber particles from the latex diluted with water (Biffen's patent) or a modification of it which is announced from Ceylon; but until a considerable number of the plants in the larger plantation are large enough to be tapped it will, I consider, be sufficient to go on as we are doing.

I beg to append extracts from my last inspection notes of the Mergui Plantation relative to the preparation, drying, and packing of the rubber, and the account sales of the last two consignments, from which it will be seen that our rubber fetches excellent prices. The price of Fine Para opened at 5s. 1d. in 1905 and in the second week of March stood at 5s. 5d.

Extract from Inspection Report on Rubber Plantation at Mergui.

* * * * *

THE PREPARATION OF RUBBER.

3. The preparation of the rubber has been vastly improved by the Manager (Mr. J. W. Ryan), but still leaves room for further improvement. For example, the biscuits are of various shapes and sizes, some being very thin and shrivelled up. It is desirable that all should be as nearly as possible alike. Moulds of several kinds have been tried, but they do not give better results than the ordinary soup-plates. Plates of the same size and make should be used so that the pancakes may be the same. A measure or ladle should be used for putting an equal quantity of latex in each

plate so as to obtain cakes of equal thickness, say, eight to the pound.

The marking of the pancakes or "biscuits" may be, and to some extent is, done by hand by pressing each cake with one of the plates originally intended to be used in the moulds. This is a slow and expensive method which will be improved upon when the yield increases. The cane hammocks on which the pancakes are hung to dry are allowed to sag too much, so that the cakes of soft rubber become deformed and unsightly. If the cane will not bear stretching tight it will be better to use wire-netting, say of two-inch mesh, on which the cakes of rubber will lie flat. The pancakes when removed from the plates or moulds are very soft and of a creamy white colour. I noticed that the liquor which moistens them is sticky and gives the cakes a sticky coating apparently of some gum-resin, which is very apt to get mouldy in damp weather. This must be remedied either by diluting the latex before it is poured into the plates or by throwing the pancakes into clean water and washing them when they are taken out of the moulds. It will also be a good plan to subject them afterwards to pressure so as to squeeze out moisture and imprint the Government mark upon them before putting them on the racks to dry.

SOME RECENT RUBBER SALES FROM MERGUI.

Account sales of four packages India Rubber shipped by the undersigned per ss. "Derbyshire" to London, sold by order and for account and risk of the concerned.

Forest Department Rubber Consignment Account No. 6,
Invoice 170. 1903-1904. shipment.

		Cwt. qr. lbs.	£ s. d.	£ s. d.
H1 1 case gross T/D 38/2	...	... 1 1 11 0 1 12		
Nett	...	... 0 3 27	28 4 3	
H2 1 case gross T/D 42/2	...	111 lbs. @ 5/1 ... 0 3 18 0 1 16		
		0 2 2	12 16 2	
Hs 1 case gross T/D 40/2	...	58 lbs. @ 4/5 ... 1 1 1 0 1 14		
		0 3 15	25 3 3	
H4 1 case gross T-D	...	99 lbs. @ 5/1 ... 0 1 0 0 0 2		
		26 lbs. @ 4/6	5 17 0	
Discount allowed to buyers 2½ %	...	...	72 0 8 1 16 0	70 4 8
<i>Home Charges.</i>				
Freight on 3-2-5 @ 52/6	...	...	0 10 10	
Landing, weighing, tarring and sampling	...	...	0 16 9	
Wharf rent and Fire Insurance	...	...	0 1 8	
Porterage, stamps and petties	...	...	0 2 5	
Brokerage @ 1 %	...	...	0 14 5	
Commission 5 %	...	...	3 12 0	5 18 1
			64 9 7	
Exchange for o/d remittance to Rangoon 1/4	...	Rs. a. p. ...	Rs. a. p. 961 3 0	
<i>Rangoon Charges.</i>				
Marine Insurance	...	4 9 0		
Shipping and petty charges	...	10 10 0	15 3 0	
Nett proceeds	...	...	946 0 0	

RANGOON:
20th July 1904.

E. & O. E.
(Sd.) FINLAY FLEMING & CO.

Account sales of six cases India rubber shipped by the undersigned per ss. "Warwickshire" to London for sale on account and risk of the concerned.

Invoice No. 187, Forest Department Consignment No. 7,
1903-1904 shipment.

	Cwt. qr. lbs.	£ s. d.	£ s. d.
1/4 = 4 cases gross	... 4 0 9		
Less T 136 + D 8 lbs.	... 1 1 14		
	2 3 5		
5 1 case gross	= 313 lbs. @ 5/3 1/2	82 16 4	
Less T 43 + D 2	... 0 3 25		
	0 1 17		
	0 2 8		
6 = 1 case gross	= 64 lbs. @ 5/3	16 16 0	
Less T 41 + D 2	... 1 1 15		
	0 1 15		
	1 0 0		
7 = 1 bag gross	= 112 lbs. @ 4/11	27 10 8	
	... 0 0 11		
	0 0 1		
	0 0 10		
	= 10 lbs. @ 3/8	1 16 8	128 19 8
Less discount 2 1/2 %			
Interest allowed to buyers	... 3 4 6		
	0 3 5	3 7 11	
	...	125 11 9	
<i>Home Charges.</i>			
Freight	... .	1 1 8	
Landing, weighing, taring, opening for customs, etc.	... .	1 11 0	
Rent	... .	0 1 0	
Fire Insurance	... .	0 2 1	
Porterage of sample, stamps and petties	... .	0 1 0	
Brokerage @ 1 %	... .	1 5 9	
Commission @ 5 %	... .	6 9 0	10 11 1
		115 0 3	
At exchange 1/4 1/2	... .	Rs. a. p.	Rs. a. p.
	... .	...	1,721 13 0
<i>Rangoon Charges.</i>			
Marine Insurance	... .	7 6 6	
Shipping and petty charges...	... .	21 5 6	28 13 0
Nett proceeds	... .	...	1,693 0 0

RANGOON:

12th November 1904.

E. & O. E.

(Sd.) FINLAY FLEMING & Co.

MISCELLANEA.

THE FORESTS OF THE GWALIOR STATE.

We have received a report containing much of considerable interest on the Gwalior State forests compiled by Mr. J. D. St. Joseph, Chief Forest Officer. This officer was deputed, at the request of H. H. Maharaja Scindia and under the orders of the Political Agent, Bhopawar Agency, to report on these forests and to draw up proposals for their future management and conservancy. During the field season the forests in the Gwalior and Isagarh Prants (divisions) as well as those of the Amjhera district of the Malwa Prant were inspected. The forests of Singoli, Agur and Sonkuch, also in Malwa, remain to be inspected. The first two lie in the dry zone of Rajputana, and it is said that their vegetation will therefore resemble that of the deciduous forests of Central India.

The Gwalior State is included in the Central Indian plateau, but the physical features of the area vary considerably. The northern portion consists of plains country with low detached hills in its southern portion and covers an area of 5,800 square miles. The southern portion, 17,900 miles in extent, has a general elevation of 1,500 feet, the hills rising to 2,000 feet. The State lies on the watershed of three rivers, the Chambal, Nerbudda and Mahi. The plains country is practically devoid of forest with the exception of small patches on the low hills or in ravines. The forests cover the rugged country and uplands of the southern portion of the area.

The report describes the geological formation, soil and climate, and then proceeds to a consideration of the requirements of the people as regards forest produce.

Generally speaking, the inhabitants are described as a poor class of agriculturists, labourers and cattle farmers. In the towns and larger villages where the people are richer they are of Aryan stock, but within and in the neighbourhood of the forests the

inhabitants consist of aboriginal tribes, chiefly Minas, Saharias, Bhils, Bhilalas, Gonds and Korkus, many of whom follow no agricultural pursuits but live by the sale or barter of forest produce. These tribes maintain themselves partly on jungle products and partly by practising that most wasteful and ruinous of all methods of agriculture (if it can be so termed) "jhuming*" to which various local terms are given. This is practised without let or hindrance, and no slope or gradient, however steep, escapes this ordeal. We trust that it will be found possible to prohibit this practice in the forests still remaining to the State, for its continuance cannot but have a terrible effect upon the future of the country. The cattle of the adjoining villages graze without hindrance in the forests.

The chief tree of the forests is the teak, which reaches the northern limit of its habitat in the latitude of Sipri. The felling of this tree has never been restricted, and it is said to have been nearly exterminated in many parts, whilst the present stock is described as wretched and almost valueless. After teak, *beja* (*Pterocarpus marsupium*), and shisham (*Dalbergia latifolia*) are the most valuable timbers, which are sparsely spread throughout the forest area on slopes and hills. These have also been overcut. Stumps of three feet in girth are met with. Anjan (*Hardwickia binata*), the next important tree, is only found in the Amjhera forests, its home being in the Amjhera Ghats, which are said to be full of seedlings, young trees and old stumps and stems shamefully hacked about by Bhils. Khair exists, and is valued for the cutch it produces. It is plentiful, but wherever accessible has been overcut for fuel; trees five—six feet in girth and 30—40 feet in height are met with. The woods in common use among the agriculturists are saj (*Terminalia tomentosa*), tinas (*Ougeinia dalbergioides*), dhaora (*Anogeissus latifolia*), dhau (*A. pendula*), dhaman (*Grewia* sp.), seja (*Lagerstramia parviflora*), tendu (*Diospyros melanoxylon*), nim (*Melia indica*) and kaim (*Stephegyne parvifolia*). They are all more or less well represented, but under the system of unrestricted cuttings in vogue the stock in tracts along main channels of export has been greatly

* The felling of a patch of forest, burning it over, and raising one or two crops upon it. The area is then deserted and a fresh patch of forest cleared.—HON. ED.

diminished both in quantity and quality. Salai (*Boswellia serrata*) usually predominates on the dry tops of hills and plateaux and hot dry southerly aspects. Achar and mahua are valued for their fruits and flowers, whilst lac is collected from the chola and kussum. Bamboos are sparsely represented and poor in quality. Owing to their easy extraction and great value they have been greatly overcut.

The past treatment may be summed up as follows. Owing to the total absence of proper forest conservancy and the system of extraction by lease and permit holders all straight and serviceable timber of marketable dimensions has disappeared, as has been the case in so many other Native States. The present stock consists of crooked and unsound material, and the forests will require very careful conservancy to bring them back to a condition which will ensure a supply of the necessary forest produce being available for future generations. So far as there can be said to be any management the forests appear to be under the charge of three separate departments—(1) Areas under the Land Records, called reserved forests ; (2) Areas allotted to the Military Department for fodder, called military *Dangs* ; (3) Areas under District Officers leased to zamindars or included in their revenue holdings, called miscellaneous *Dangs*. The amalgamation of (1) and (3) is under consideration and leases which fall in are not renewed. A small establishment is entertained for the so-called reserved forests, and a code of rules was formulated last year, but the provisions are not yet in force. Receipts have apparently risen during the last three years, but in the absence of any regular system of management this cannot be looked upon as a matter for congratulation. No sowings and plantings have ever been undertaken, nor any other works of improvement.

The future management of the forests is discussed, a detailed statement being given showing the proposed blocks of forests to be conserved and their boundaries. The proposals for establishment suggest that a Deputy Conservator from the Indian Establishment should be appointed as Conservator in charge of the State forests, which it is proposed to divide up into some twelve Ranges. After

dealing with the sources of revenue, Mr. St. Joseph estimates the receipts at about Rs. 2,65,000 and charges at Rs. 1,35,000, or a surplus of Rs. 1,30,000.

We sincerely trust that the Durbar will give this report careful consideration, since the future of the country may be said to depend in great measure on the immediate and complete checking of the reckless fellings and the maintenance and improvement of the forest growth still existing in the State.

GOLD WASHING IN THE SONA RIVER.

We have received the following information, together with the accompanying illustration, from Mr. Hobart-Hampden, Director of the Imperial Forest School, Dehra Dun, on the subject of the gold-washing operations undertaken by the local inhabitants in the Sona Nadi, a river situated in the Ganges Division of the Western Circle, United Provinces: "A small colony of Boksars, an aboriginal tribe akin to the Tharns of the Tarai, has for long lived on the Sona Nadi and occupied itself in washing for gold. They only make about four annas a man a day. Their implements are of the roughest. The Sona Nadi runs down a broad open valley, surrounded by steep hills and connecting with the Ramganga valley just below Boxar."

THE FELLING OF WHITEWOOD IN RUSSIA.

[Translated from the Russian *Lesopromishlenny Viestnik* (timber exporters' news), of the 19th May (1st June), 1905.]

In whitewood forests, Government as well as private owned, the method of felling now in vogue is generally partial, i.e., of selected dimensions only. In the Government forests the buyers take the larger sizes, from six vershoks and thicker ($10\frac{1}{2}$ inch tops diameter), and in those belonging to private individuals from four vershoks and up (7 inch tops). On examining the felled areas in after years in both the above categories of forest, we came to the conclusion that there was an exceedingly large quantity of dry standing timber. After considerable study we decided that in



Gold-washing on the Sone River, Ganges Division, United Provinces.

Government forests, where the thicker sizes only were felled, the quantity of dry wood equalled that of the quantity taken out, and consisted more particularly of matured timber, while in forests belonging to private owners where thinner dimensions were cut down (7 inch diameter tops), the quantity of dry timber was very great indeed. We are inclined to attribute such a considerable deterioration of timber to the thinning of forests by felling the merchantable trees to such an extent that the remainder are swayed by the wind, and through the continual rocking movement the smaller fibres of the root break in the ground, the consequence of which is that the tree receives insufficient nourishment. After that its complete destruction is but a matter of time.

It is evident from the above that the system of felling of timber as practised at present is faulty in the extreme, and should be discarded for a more perfect one, and one by which such a considerable proportion of standing timber would not be spoiled. The felling of picked dimensions is only possible in cases where wood is of no great value. Now that forests have become exceedingly valuable property, it is necessary that the Department of Forestry should work out a scheme which would not only give the greatest possible return, but would, at the same time, not cause the property itself to deteriorate in value. It can scarcely be termed satisfactory business when, after felling a certain number of trees, an almost equal quantity are irreparably damaged, all through our lack of knowledge of forestry. In view of this it becomes a matter of vital importance to determine the maximum number of trees which it is permissible to fell, without causing harm to the remainder. Various trials in whitewood forests should be made, for besides the dead loss of the dry wood, the whole property deteriorates, for these trees attract numerous harmful insects, the wood falls in time, choking up the forest, and the wind, with greater scope than ever, completes the work of devastation. Obstructions in forests such as are caused by fallen trees are conducive to fires, the harm of which it is unnecessary to dilate upon. Experiments should be undertaken for a number of years in one centre. We consider that these should be carried out in

Government forests by placing aside experimental areas and determining in that way the maximum number of trees which it is feasible to fell simultaneously without harming the remaining timber.

THE EDITORSHIP OF THE FAUNA OF BRITISH INDIA.—We understand that the Secretary of State has offered the Editorship of the Fauna, vacant owing to the lamented death of Dr. Blanford, to Colonel C. T. Bingham, lately retired from the Department, and that the latter has accepted. We feel sure that we are voicing the sentiments of the Service when we extend our heartiest congratulations to Colonel Bingham on the well-deserved honour done him and, through him, to the Department.

CANADIAN LUMBERMEN AND THE WATERWAYS OF CANADA.—In a wood-producing country it is a matter of the utmost importance that waterway rights should be clearly defined, and we are therefore glad to learn that disputes between Canada and the United States over the international waterways are in a fair way to be settled. The work of the Waterways Commission jointly appointed had, in the first place, to be abruptly broken off in consequence of a misunderstanding between the Canadian and United States Commissioners respectively as to the scope of the enquiry. The Canadians had gone into the work in the belief that all questions arising out of the waterways would be dealt with. The Maine lumbermen, who are interested in the rights of lumberers and navigation of the St. John River, insisted that the St. John River issue was outside the scope of the Commission, and an examination of the reference showed that this was so, the waterways to be the subject of discussion being described as those flowing into the lakes and the St. Lawrence, and emptying into the Atlantic. This would, of course, shut out the St. John River, which flows into the Atlantic by way of the Bay of Fundy and the Rainy River lumber dam—a matter to which Canadian lumbermen attached great importance. At one time the St. John River dispute appeared to have approached a very critical stage, when the New Brunswick authorities were being urged by

Canadian lumbermen to send a militia force down the Canadian banks of the St. John to protect the local authorities in blowing up the booms, which the American lumbermen had thrown across the river into Canadian waters, but the intervention of the Ottawa authorities quieted the excitement. The rival lumbermen signed a truce pending a legal adjustment of their respective claims. Meanwhile, the points in dispute are to be handled by a joint Sub-committee, who will be ready to report to the Waterways Commission as soon as the latter body has had conferred upon it the legislative authority to deal with the question. In the interests of the lumber trade on both banks of the St. John River, it is hoped that the Commission will be able to precisely define what are the treaty rights of both countries, and to arrive at a friendly settlement of all the matters in dispute.

THE FISHING INDUSTRY IN MADRAS.—We understand that the Government of Madras recently addressed the Government of India on the subject of an investigation being made into the fisheries of Madras. Their proposal was that Sir. F. A. Nicholson should be deputed to make a careful investigation of the fishing industry with a view to its improvement. Whilst considering that the Government of Madras had underestimated the cost of such an enquiry the Government of India gave their hearty approval to the scheme. Sir F. A. Nicholson has been appointed for two years, the first to be spent in India, the second, or such part as may be necessary, in Europe.

IRISH FORESTRY SOCIETY.—The third annual meeting of the Irish Forestry Society was recently held in the Mansion House, Dublin, the chair being occupied by the President, Lord Castletown.

Mr. Field, M.P., in moving the adoption of the report, pointed out that in his opinion the subject of reafforestation had been neglected because the majority of the people did not understand the utility or necessity for reafforestation. He spoke at length as to the benefits derived in other countries from their forests, and the advantages, both commercially and otherwise, that may be realised at Home, were the subject taken up in a whole-hearted manner by

the Government and by the people themselves. He had himself moved in Parliament to have a clause inserted giving County Councils powers to acquire waste land for the purpose of planting. Unfortunately Mr. Gerald Balfour did not see his way to accept the suggestion. Section No. 4 of the Land Act, however, gave the County Councils certain powers to spend money and obtain land, but the power had not been exercised to any extent. He had endeavoured to move the Dublin County Council in the matter, but there was a difficulty in obtaining money and also in getting men to work earnestly. Both earnestness and the means to carry it out were required. The Department of Agriculture had spent £10,000 in establishing a practical school of forestry in Avondale, and it had done good work, but it was really a very moderate attempt towards introducing the study of forestry in Ireland. At one time Ireland was known as the "Wooded Isle," but now, he believed, it was one of the most treeless countries in Europe. (Hear, hear.) Something should be done by those in authority to see that wherever a tree is cut down another should be planted. (Applause.)

Mr. H. de F. Montgomery, D.L., seconded the adoption of the report, and urged the formation of State forests. As a member of the Board of Agriculture, he knew the Department had not the funds to embark on large schemes of planting. The money was all wanted for the improvement of live stock and agricultural education. The Department had made arrangements for an expert to deliver a course of lectures on forestry at Avondale. He pressed the members to make an effort to get a clause introduced this session into the Lands Improvement Act making the planting of trees, for profit or otherwise, one of the things for which money should be lent under the Act.

The report was unanimously adopted.

On the motion of Mr. Moran, seconded by Mr. Lambert Jones, the President, Officials, and Executive Committee were unanimously re-elected.

Lord Castletown, after paying a tribute to the work done by the Officials and Committee, and the late President, Dr. Cooper,

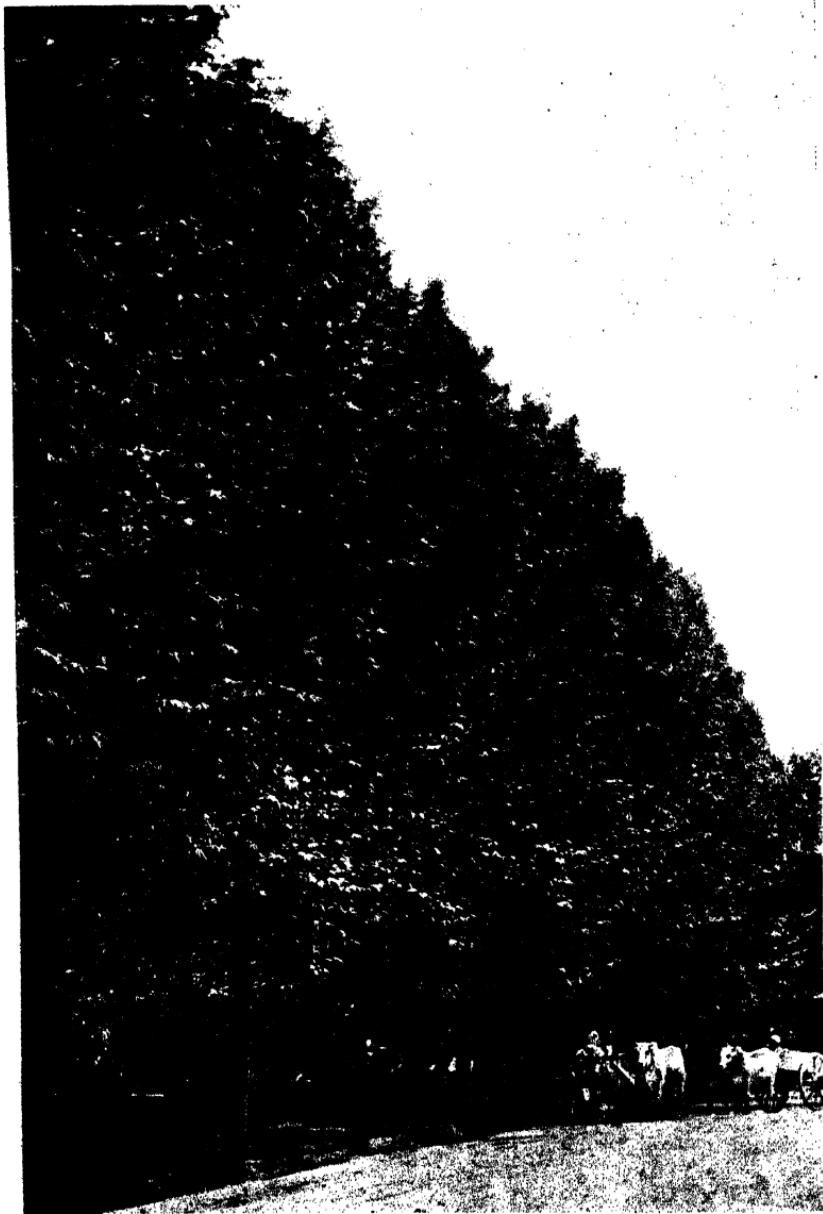
said he believed the public were beginning to think there was something in the idea of afforestation. There were signs that the work done by the officers was beginning to bear fruit. There was an idea that Irish timber was not as good as foreign timber. That was far from accurate. Mr. Nisbet, one of the greatest authorities, had examined timber in Waterford, Cork, Tipperary, and elsewhere and had found it as suitable, if not more suitable, and of better character, than foreign timber, although a great deal of it was grown on wrong principles. He proposed to present the society with some books, recently published, which might give valuable hints.

THE WOODS OF IRELAND.—In the House of Commons on Friday last week, Captain Donelan asked the Chief Secretary to the Lord Lieutenant of Ireland whether it was proposed to take any steps with a view to preserve the few woods and plantations still left standing in Ireland. Mr. Long said that the Department of Agriculture were alive to the importance of the question. They had caused special inquiries to be made, and had been in communication with the Estates Commissioners with a view to the utilisation of Section 4 (1) of the Act of 1903. The Department had themselves purchased, as trustees under this section, certain woods which would be utilised in connection with the Department's forestry station in County Wicklow. The Department's funds were not sufficient for any comprehensive scheme of forestry development, but facilities were being provided under the county agricultural and horticultural schemes for encouraging the planting of trees and the preservation of existing woods by occupiers. Captain Donelan asked whether action would be taken to prevent landlords from cutting down the timber on their estates when selling under the Land Purchase Act. Mr. Long said he had never heard any suggestion of the kind before.

GAME PRESERVATION IN ASSAM.—The additional forest reserved in Assam for game preservation has been selected with the same discrimination as the others. It consists of nearly 60,000 acres, partly in the Nowgong and partly in the Sibsagar district, interferes with no cultivation, and being bounded on all

sides by rivers, there can be no disputes. The railway running as it does on the outskirts of the north will give easy access to the place when the animals have recovered from the decimation they have been subjected to for many years past. A good many shed antlers used to be brought in from this forest, but when masks also came on the market no wonder the authorities became sceptical and closed the place! Permits will, no doubt, as in other reserves, be granted to genuine shikaris for tiger and leopard shooting, and in three or four seasons for stags, but potting for commercial purposes is at an end in the Kayiranga.

THE CALCUTTA ZOOLOGICAL GARDENS.—The Government of India have decided upon the enlargement of the Zoological Gardens which has been a much needed requirement for some time past. Some adjacent vacant grounds are now to be made over to the Garden authorities, and we trust that this valuable addition to the grounds will lead to several other houses being erected, and amongst them an Insect House. In a country of the size of India and possessing such a wonderful variety of insect life such a house would be both interesting and of considerable economic utility.



Chinar (*Platanus orientalis*) Avenue on the Lytton Road, Quetta.

INDIAN FORESTER

OCTOBER, 1905.

ON THE IMPORTANCE OF A KNOWLEDGE OF MODERN LANGUAGES TO THE SCIENTIFIC FORESTER.

In a recent article on the future training of the Upper Controlling Staff of the service a list of the subjects comprised in the course of study which will be followed at Oxford was given. The list so far as it goes is a good one, but there are several points which are open to criticism. A careful study of the question shows that whilst the subjects now prescribed for the competitive entrance examination—Mechanics and Physics, Chemistry, Zoology and Botany—are in themselves excellent, several others, equally necessary, have been omitted, whilst the standard upon which the examination is based is so low that it will be impossible by its means to obtain the best men. It is scarcely necessary to point out that the very essence of an examination is to, by its means, single out the best of the competitors, and this can only be done by setting a high standard. Attention has been drawn to this issue in *Nature*,* where, under the title of "Entrance Examination to the Indian Forest Service," a writer, after drawing attention to the inadequacy of the proposed entrance test, continues "When we remember that in the Indian Civil Service examination the standard of subjects is that of an honours examination; that a candidate takes not three subjects, but eight, nine, ten or more, it is obvious that the Secretary of State is trying to recruit Forest officers from men of a markedly inferior intellectual range, and the strictures which were passed by Sir George King on the Indian foresters at the Dover Meeting of the British Association will probably need repeating a few years hence." All will, we think, endorse the opinion that whatever the nature of the subsequent

instruction given to the Forest recruit may be, the standard of the entrance examination should be such as to enable the examiners to pick out the best men who present themselves, and that these men should preferably be graduates. We can see no adequate reason for limiting the candidates to school-boys and University freshmen.

But there is another aspect of the proposed entrance examination and subsequent tuition to which we would wish to draw attention. It is the important question of the necessity to the scientific man of the present day, amongst whom the Forest officer naturally takes his place, of an adequate knowledge of modern languages, and by modern languages we allude here more particularly to French and German. The present entrance examination prescribes no modern languages, although we are given to understand that in the future German will be added to the subjects to be examined in. In the schedule of subjects to be studied at Oxford we see that this language forms one of the subjects of tuition. We may ask *en passant* whether the spectacle of a graduate commencing the study of a modern language at a University has not its ludicrous aspects ! Why, we would enquire, need the language be taught at all during the special training ? Every hour available is required for this latter, and those given to school-boy classes are thrown away. Why not require from the competitors at the entrance examination such a knowledge of the language as is required from the candidates in the Indian Civil examination ? The successful recruit at the latter does not proceed to the University to continue the study of French or German. That part of his education has been accomplished.

But we wish to go further here. We would ask why is it that German is the only language prescribed ? There are many who consider that French forestry is not one whit behind that of the German. Leaving aside such controversial questions, however, few would be found to deny that French forest literature is on a level with and ranks with the best of the German. Why therefore shut out from the present recruit the whole of the literature of the Forest Service of a great nation by laying such stress on the knowledge of the language of a neighbouring one, and why

undertake what should be an entirely unnecessary burden, its tuition during the special course of training the recruit undergoes?

We are of opinion, an opinion shared we are aware by many who have given the matter the most careful consideration, that the education of the scientific forester, and we use the term in its widest sense, is incomplete unless he is armed with a working knowledge of the French and German languages, unless he possesses such a knowledge of both that he can peruse with facility the literature of either country. Such a knowledge, we say, is indispensable to the scientific forester in executive charge if he wishes to keep himself *au fait* with the continual growth in the scientific ways of treatment and tending of the forests, with new methods of extraction, treatment of mountainous areas, etc. But if such is a necessity to the forester who is a forester at heart as well as in name, it is an essential to the officer who specialises in any one of the many branches open to specialisation which the varied nature of his duties present to the forester. It may be sylviculture or chemistry, the protection of hill tops and the checking of mountain torrents, specialisation in methods of extraction or in botany, forest fungi or forest zoology or mathematics. In one or all once interest has been aroused to the point of deciding an officer to take up a certain line he is at once faced with the wish to obtain all the available literature on that subject, and, when obtained, with the problem of reading it. If he has the command of but one of the two languages we are considering at his disposal that man can never develop into the specialist he aims at becoming until he has acquired a working knowledge of the language he is without. It is not necessary to harp further upon this point. Every specialist, every scientific specialist, is aware of the fact.

Now the men of the Forest Service are essentially specialists in that the forest portion of their duties, as distinguished from the heavy administrative ones, are of a nature which require a very careful and special training to enable them to be carried out, and this training does not end when the student joins the service. The Forest Officer, as has been well said, is ever at school, and to enable him to remain there with the greatest profit to himself and

the Government he serves we would strongly recommend that the entrance examination should prescribe a knowledge of French and German, and such a knowledge as would render it unnecessary to continue the teaching of those languages during the special course. In the interests of the Government which both serve we would suggest that in these subjects one and the same papers should be set for the Indian Civil and Forest Services ; for whereas in the former case the knowledge may be considered an intellectual requirement, for the latter it is in addition essentially a professional necessity and one of the utmost importance to its members in their future official careers.

SCIENTIFIC PAPERS.

SOME INDIAN FOREST FUNGI.

PART II.

BY DR. E. J. BUTLER, M.B., F.I.S.,

CRYPTOGAMIC BOTANIST TO THE GOVERNMENT OF INDIA.

A number of exceptionally interesting fungi of the order Uredineæ, more commonly called rusts, occur in the Himalayan forests. They are perhaps the best known of all Indian fungi from the work of the late Dr. Barclay of the Indian Medical Service, who in the short space of six years, from 1886 to 1891, published over twenty papers dealing with these fungi, and described 109 species, of which 72 were new to science. It has since become clear that he only touched on the fringe of a vast subject. Almost all his species were collected in the immediate neighbourhood of Simla, and as we pass along the range the variation of the fungus flora keeps pace or perhaps exceeds that of the general flora. The Mussoorie and Jaunsar barberries, for instance, bear an entirely different *Æcidium* from that on the Simla ones. A few scanty observations around Darjeeling have convinced me that the rusts of the Sikkim Himalaya differ widely from those further west. I believe that the Himalayan range is one of the richest regions of the globe in the members of this group. They have, however,

almost escaped the attention of collectors. The Sikkim species are practically untouched, and our knowledge elsewhere, excluding Simla, is confined to the most conspicuous forms in a few easily accessible spots.

It is necessary, in order to render intelligible the following notes, to deal briefly with the general characters and often complicated life-history found in the order. All are parasitic, and the most destructive of known fungus diseases of cultivated plants are caused by the members of this group. Such are the rusts of cereals, annually responsible for the loss of millions in the grain-producing countries, the coffee leaf disease, which destroyed the planting industry of Ceylon some forty years ago, the linseed rust, exceedingly destructive in India, and many others. Most are confined to a single species or to a few closely allied species of host; the host being almost invariably a flowering plant. Unlike the fungi with which we are chiefly familiar, such as the mushrooms and moulds, which can get their food from a variety of substances, the rusts require food of a definite composition, and usually find it only in one or a few living plants. It speaks volumes for our ignorance of the true composition of living plant substance that their artificial cultivation has never yet been accomplished. But the most remarkable phenomenon in the group is that known as "heterœcism" or the passing of different stages of the life-history on different and often widely separated host-plants. It is an eccentricity entirely comparable to that of the parasite of malarial fever in man, which, as we know, is obliged to pass a portion of its life in the body of the mosquito. Within recent years science has had its interest awakened in this class of parasite, and we may expect to find other diseases due to the development of so objectionable a character, long known however in the fungi and some lower animals, added to dengue, sleeping sickness, yellow fever, malaria, &c. Another phenomenon exhibited by the rusts which may also have its counterpart in the parasites of man is that of "specialisation." Some of the species which attack several hosts have got split up into races without any external difference but each confined to its own variety of host and

unable, without some difficulty, to attack the hosts of the others. It is as if we should imagine that plague, to which Europeans are now comparatively immune, but which once ravaged Europe (if indeed the Black Death were plague), had got from long restriction to the East developed into a race no longer capable of readily attacking whites, while the parasite in Europe had gradually died out completely. The black rust of cereals attacks both wheat and oats, and the forms are absolutely alike, and beyond doubt are of one origin; yet that on wheat cannot pass to oats, in India at any rate, and as the race on oats has not yet been introduced here, we commonly have, as in Dehra Dun, the remarkable sight of fields of wheat severely attacked with black rust alongside oat fields where not a trace of the disease can be found.

In the life-history four stages are usually recognised. These may all be passed on the same plant or some may be passed on one plant and the others on another. They are known as the aecidial, uredo, teleuto and sporidial stages.

The aecidial stage, or *Aecidium*, consists of a little plant body or mycelium formed of thread-like cells running between the cells of the host plant and obtaining food from them by means of little suckers pushed through their walls. It is usually found infesting leaves, but sometimes occurs on shoots, flowers and fruit as well. It is marked by the formation, as reproductive bodies, of aecidiospores, usually minute, yellow, spiny bodies enclosed in a cup-like receptacle, of which the cluster cups of the barberry are a more or less familiar example. With these a second spore-form, the "spermatia," whose meaning is not clear, is often found. On germination the aecidiospores usually give rise to the uredo stage.

The uredo stage also consists of a mycelium much like the first, but it gives rise to uredospores which differ in colour, size, shape or some other character from the aecidiospores. They are formed under the epidermis and are without the little cup-like receptacle.

The telento stage arises from the same mycelium usually as the last stage, and the two together may therefore be taken as forming one stage only. Teleutospores are formed usually after

the uredospore production has finished, but sometimes amongst the latter. Unlike the two preceding, the teleutospore is often composed of more than one cell, and instead of being able to germinate immediately it is frequently a "resting-spore" requiring a lapse of several months from its formation before it germinates.

The sporidial stage results from the germination of the teleutospore. Instead of a mycelium being formed within the plant, a short projection grows out from the teleutospore into the air, and on this a few small spores, the "sporidia," are produced. On germination the sporidia give rise immediately to the *Aecidium* again.

Now the remarkable fact remains that the aeciospores on germination are often unable to produce the next stage unless they happen to fall on a different plant to that on which they were borne. Thus the barberry cluster-cup spores cannot attack the barberry itself, but if they come into contact with wheat, barley, oats, etc., they complete their development by giving rise to a mycelium within these plants, eventually bearing uredo and teleutospores and causing the destructive black rust of cereals. Similarly the sporidia resulting from these teleutospores cannot infect a cereal plant, but only a barberry. Just as a malarial parasite in the blood of man must die with its life but half completed unless a mosquito should suck it up, so the sporidia are obliged, in order to complete their cycle, to come into contact with a barberry bush. But as it appears probable that the malarial parasite can live in one stage for many years and induce ague in man years after exposure to mosquito bites has ceased, so also it is certain that the uredo stage of some rusts can be reproduced for years without the intervention of the other stages.

So much being clear, the description of some species which I have received chiefly through the kindness of Forest Officers can be proceeded with.

CHRYSMYXA HIMALENSE, BARCLAY.

In two papers in the "Scientific Memoirs by Medical Officers of the Army of India," in 1890 and 1891, Barclay described some Uredineæ on Himalayan species of rhododendron, and discussed their relationships, which were rather puzzling.

Around Simla a teleutospore form, which Barclay named *Chrysomyxa himalense*, is extremely conspicuous on *Rhododendron arboreum*. Comparing it with its European relative *Chrysomyxa Rhododendri*, D. C., Barclay sought for its aecidial stage on *Pinus excelsa* and on *Picea Morinda*. In Europe the Aecidium of the *Rhododendron Chrysomyxa* occurs on *Picea*

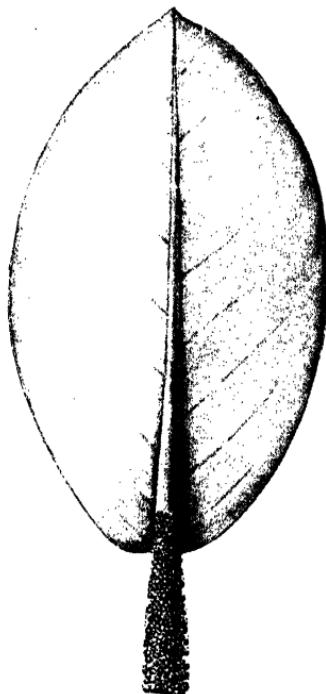


FIG. 3.—*CHRYSMYXA HIMALENSE* ON *RHODODENDRON CAMPANULATUM*.

excelsa. In India, however, Barclay could get no experimental evidence that his *Chrysomyxa* was connected with any conifer.

Later on he obtained an Aecidium on *Rhododendron campanulatum* and a Uredo on *R. lepidotum*, and the possibility immediately presented itself that the three stages of

his Chrysomyxa were passed on the rhododendrons without the intervention of any other plant.

In specimens received from Mr. Hole, I. F. S., from Jaunsar in 1904, the teleuto stage of Chrysomyxa himalense was found by me on *Rhododendron campanulatum*.

Sir G. Watt also stated in a footnote to his Review of Dr. Barclay's works published in the 'Agricultural Ledger' in 1896 that he found an *Aecidium* on *R. lepidotum* which Dr. Barclay declared solved the mystery of these fungi. This it could only have done by proving identical with that on *R. campanulatum*. Hence we have an aecidial and a teleuto form co-existing on *Rhododendron campanulatum*, and probably the same *Aecidium* and a uredo form co-existing on *R. lepidotum*. The possibility suggested by Barclay that this fungus passes through all its stages on the rhododendrons therefore becomes a probability, and the theoretical interest of this is considerable.

The origin of the remarkable power of changing hosts ("heterocicism"), such as is found for instance in the case of the malarial parasite and in many rust fungi, has naturally given rise to much speculation. Anything throwing light on it is therefore of value. Some have supposed that it is capable of explanation on the descent theory, the parasite having affected the two different hosts from the time of their common ancestor. In the case of the mosquito and man this takes us very far back indeed, and for the rust fungi we should have to look even farther. Others suppose that the parasite originally attacked both hosts and completed its development on each, subsequently losing one portion of its stages on one host and the remainder on the other. But the most probable view appears to be that which considers that the parasite was originally confined to one of the two hosts, and only later, by a sudden adaptation, became capable of passing to the other.

It so happens that European rhododendrons bear, as already mentioned, a fungus, Chrysomyxa Rhododendri, which has its aecidial stage on the spruce, *Picea excelsa*. The spruce also bears the teleuto form of a second fungus, Chrysomyxa abietis.

The two are sufficiently alike to suggest a common origin. Any evidence that the rhododendron species was originally confined to one host will therefore throw some light on the development of heterocism in this case. It may either have been at first confined to the spruce and then have passed to the rhododendrons in its uredo-teleuto stage, or at first living on the rhododendrons have then emigrated to the spruce in its aecidial stage. Now, though the fungus on Himalayan rhododendrons is unlike that on the European ones in many respects, still it is not unreasonable to consider that it also is of common origin with the latter. It would then strongly support the second of these views. In the Himalaya

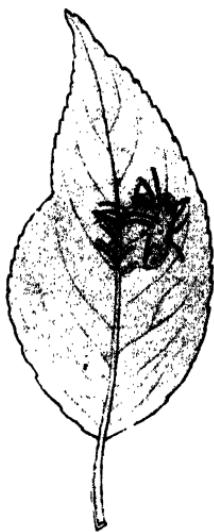


FIG. 4.—*GYMNOSPORANGIUM CUNNINGHAMIANUM*, *AECIDIUM FORM ON PYRUS PASHIA.*

at least, it is now probable that the rhododendron *Chrysomyxa* was primitively, as at present, confined to the rhododendrons. We may then suppose that in its passage westward it developed *Chrysomyxa Rhododendri* by the transfer of its *Aecidium* to the spruce. From this *Aecidium* a teleuto form arose on the spruce giving rise to *Chrysomyxa abietis*. Hence a competition ensued

on the spruce between the *Aecidia* of *Chrysomyxa Rhododendri* and of *Chrysomyxa abietis*, and, as Barclay has pointed out, in such a case the heteroecious form is the more likely to succeed. So the *Aecidium* of *Chrysomyxa abietis* was lost. The German mycologist de Bary was the first to suggest that *Chrysomyxa abietis* originated from a form living on the rhododendrons, and Barclay showed that such a form possibly occurred in the Himalaya. The discovery of the aecidal and teleuto stages both on *R. campanulatum* renders such a view at least highly probable.

GYMNOSPORANGIUM CUNNINGHAMIANUM, BARCLAV.

One of the commoner rusts in Mussoorie is an *Aecidium* on *Pyrus Pashia*, the Himalayan wild pear, which is conspicuous on the



FIG. 5.—GYMNOSPORANGIUM CUNNINGHAMIANUM, TELEUTO FORM
ON THE CYPRESS.

older leaves during the hot-weather months, in and around the station. The affected leaves bear orange-red patches, which may be half an inch in diameter on the upper surface.

On these spermagonia are formed, showing as tiny black dots, while the corresponding part of the lower surface bears little tubular *Aecidia* from one to two millimeters long.

The species also occurs at Simla, where its life-history was followed by Barclay. Its further development occurs on the Himalayan cypress, *Cupressus torulosa*.

After infection by aecidiospores from *Pyrus Pashia* the cypress develops teleutospore beds at the infected part, either on the branches or green twigs.

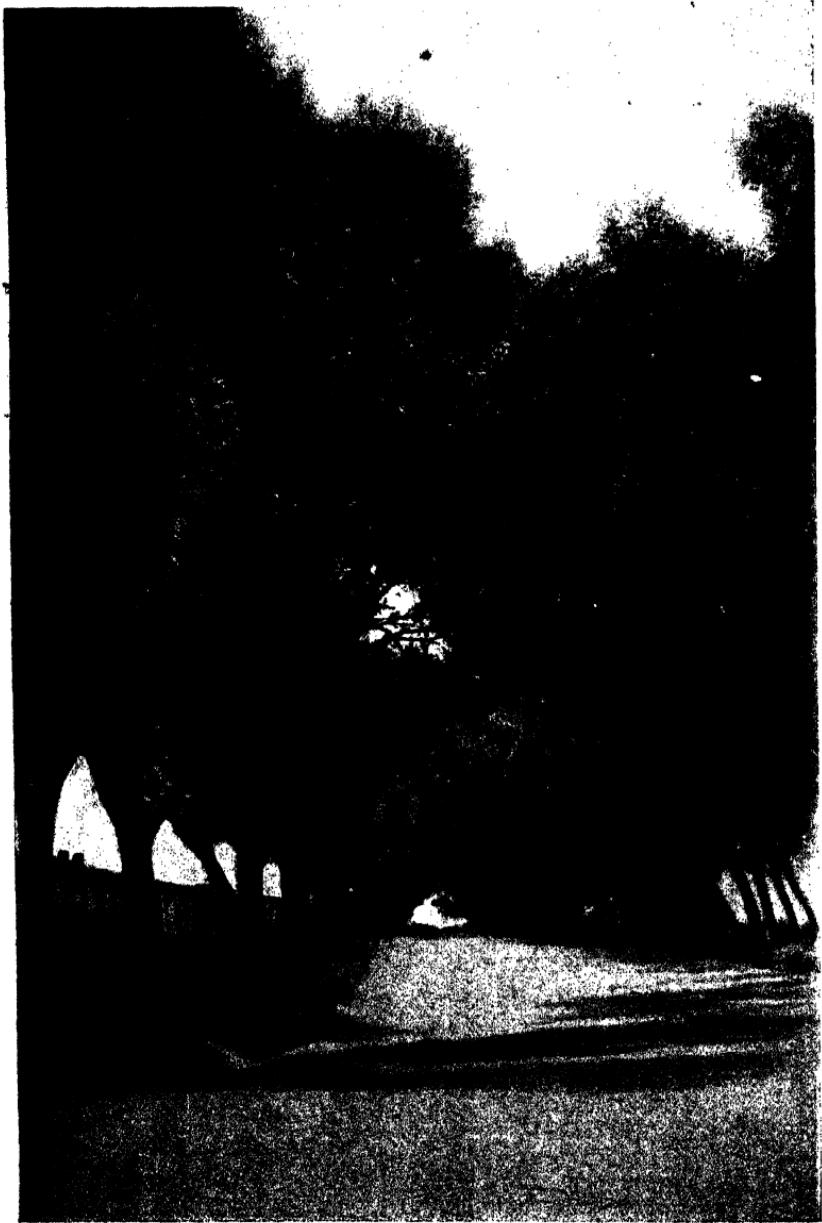
These beds are hemispherical or elongated, dark brown, bodies which during moist weather swell up enormously into gelatinous masses; later on they become yellowish in colour from the formation of sporidia on promycelia given out by the germinating teleutospores. By sowing the sporidia Barclay caused first spermagonia and then Aecidia to appear on the leaves of *Pyrus Pashia*.

In June 1904, Rai Sahib U. Kanji Lal, Vernacular Instructor at the Imperial Forest School, sent me some specimens of this fungus on cypress seedlings, and wrote that it was doing much harm in Jaunsar to young trees, especially those planted. Some of the seedlings sent were evidently dead from the effects of the parasite.

A European ally of this species, known as *Gymnosporangium Sabinæ*, is found on the juniper in the teleuto stage and on the pear tree in the aecidal stage. It causes much damage to the latter, but the destruction of the juniper trees in the neighbourhood of the orchards has, in several cases, led to the disappearance of the disease.

In Jaunsar it is possible that something of the same sort might be attempted wherever the cypress plantations are being much injured by this fungus. Removal of *Pyrus Pashia* for some distance around would probably lead to a considerable reduction in the cypress parasite in a few years.

(*To be continued.*)



Avenue of Kandahari Willows, near the Siestan Caravanserai, Quetta.

ORIGINAL ARTICLES.

THE AVENUES AND FRUIT GARDENS OF QUETTA.

BY E. P. STEBBING.

The popular and extremely pretty station of modern Quetta occupies the central highland of Baluchistan. Holdich considers that from its geographical position it must always have been a point of strategical importance as well as a considerable commercial centre. It is surrounded by gigantic mountain peaks running to 11,700 feet of elevation, the highest that Baluchistan can boast, and only eclipsed by the weird and isolated snow-capped volcano, the Koh-i-Taftan of the Persian border. Quetta is situated at an elevation of 5,500 feet above sea level, and is surrounded by an entourage of mountains such as few cities of the world can boast of. The double-peaked Takatu on the north is balanced by Chiltan on the south-west, whilst to the south-east the square-topped Muedar rears itself up into the heavens. Beyond this again to the north-east the ramparts of Zarghun close up the landscape; curious barren mountains these, blazing scarlet in the winter sunsets. From a point not far away the silver cone of Kand, which parts the headwaters of Pishin from those of Zhob, can be seen. The Mushkaf-Bolan Railway, on its way up from Sibi, runs through a dreary waste of sandy desert, covered in parts with a coarse herbaceous growth, and rocky mountains until the plain of Quetta and the valley of Pishin are reached. The result of British interference with frontier misgovernment has, by means of irrigation, in the space of a short quarter of a century, converted plain and valley in spring and summer into a green oasis amongst the mountains. Wide green vistas of crops, broken here and there by the dark patches of orchards and hamlets and forming a grateful alleviation to the surrounding howling wilderness of desolation, are now to be seen from the top of the Miri, supposed by Holdich to be the ancient débris of a mud volcano*

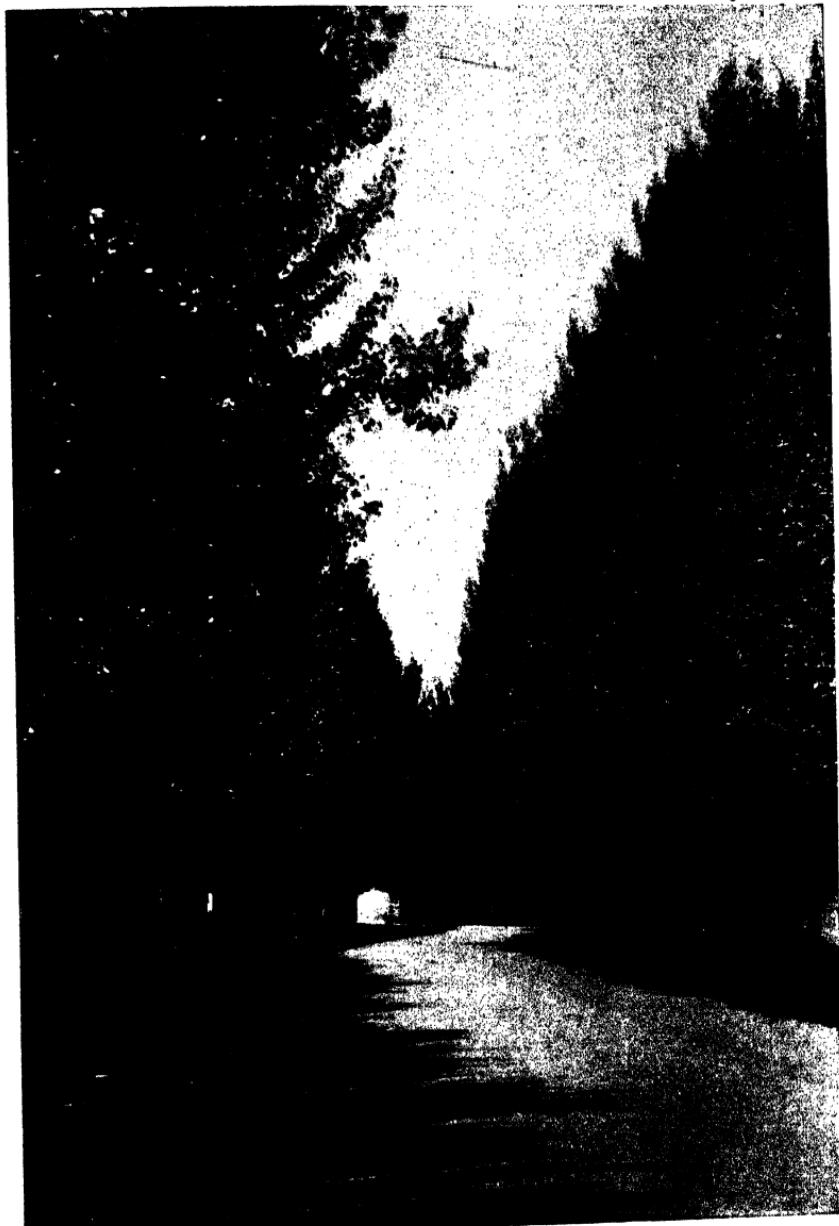
* Holdich in his 'Topography of British India' (The Regions of the World Series) alludes to the Miri as the 'ancient débris of mud volcano'. Mr. R. Hughes-Buller informs me however that excavations have shown it to be artificial.

which dominates Quetta as its fortress and protection. But delightful as are these smiling fields and orchards they are almost eclipsed by the beautiful and magnificent avenues which border the roads of the station itself. These are solely the result of the work and foresight of the first generation of Quetta's rulers, ably continued by their successors.

The great need and importance of arboriculture in India has recently been the subject of a Resolution of the Government of India, to which attention has already been drawn in the *Indian Forester*.* Nowhere perhaps throughout the length and breadth of the great continent are its enormous benefits to mankind in general so strikingly demonstrated as in the wonderful results achieved in Quetta. The illustrations with which this article is supplemented will, it is considered, sufficiently support this contention. Having been much struck, during a recent visit to the station, with the manner in which the planting work had been carried out, enquiries were instituted with a view to the possibility of writing a note upon the subject. Acknowledgment is here made of the kindly assistance received from Major Archer, Judicial and Revenue Commissioner, Baluchistan, and Major Tighe, Political Agent, Quetta ; from General Smith-Dorrien, C.B., D.S.O., and General Sir Stanley Edwardes, K. C. B., the first G. O. Commanding Quetta, through his son Major S. M. Edwardes, D. S. O. ; also incidentally from Sir Hugh Barnes, K.C.S.I., whom he consulted on the subject. As we shall see, both these latter officers were the prime movers in the original planting up of Quetta. To all these officers, as also to Mr. R. Hughes-Buller, C.S., Superintendent of the Baluchistan Imperial and District Gazetteers, and Rai Saheb Diwan Jamiat Rai, sincere thanks are due for the aid which has rendered the compilation of this note a possibility.

Sir Stanley Edwardes informs me that the trees at Quetta, when the British first arrived, consisted mainly of orchards of white mulberry and apricot. There were no large trees at all except some scattered mulberry trees in the vicinity of the fort,

* *Vide* p. 460 of the present volume.



White Poplar (*Populus alba*) Avenue, Woodcock Spinney, Quetta.

in what is now the General's compound, and also near the alignment of the present Lytton Road (in the Residency grounds), and some old willows (Kandahari ?) which stood to the west of where the railway station now stands near the site of the present railway Dhobies' Ghat.

The first steps towards planting up the station appear to have been initiated in the Civil Lines by Mr. Bruce as far back as 1878. A year later Mr. Ingle joined as Treasury Officer and Cantonment Magistrate, and continued the work both in the Civil Lines and Cantonments. Later on, after the evacuation of Kandahar, the work was taken up in a more serious fashion by Mr. (now Sir Hugh) Barnes, with whom was associated the late Colonel Gaisford; a Tree Committee being formed. Mr. A. Waston, Assistant Conservator of Forests in Baluchistan, also took a considerable part in the formation of nurseries and in the roadside planting.

The first young trees were obtained from Kandahar. Captain Anscomb, Assistant Commissioner, Quetta, to whom I am indebted for much valuable information on the subject, confirms this statement. He says that a beginning was made in the winter of 1881-82, when some 60,000 cuttings of chinar, poplar (*Reamer* variety) and willows were brought on camels from Kandahar and planted out along the roadsides and in gardens. The chinar cuttings were chiefly placed upon the Lytton Road, where they now form the beautiful shady avenue depicted in plate XLIII. The cuttings were put out in trenches, the latter being watered by irrigation channels. Water in such a country as Baluchistan is a commodity of which the value is fully understood; and very considerable skill has been shown in Quetta in making use of the amount available to raise and keep alive the beautiful avenues. The wonderfully rapid growth of the trees has exceeded all expectations. The white poplar and Kabul willow cuttings, neither of which trees Sir Stanley informs me (although now so plentiful) existed at Quetta when the British arrived, were put out upon the other roads of the station; poplars, and to a lesser extent willows, were also planted out in the grounds attached to the Residency and the General's

quarters, and other private compounds. These first batches of cuttings were procured by the Political Officers, and others obtained in the same way were planted out in Cantonments by Sir Stanley. From such first beginnings have the beautiful Quetta avenues arisen, and the wonderfully rapid growth, which is so well shown in the accompanying illustrations, has proved a most pleasant surprise to some of its original originators whom distance and retirement have long since removed from the scene of the labours of their earlier days. This wonderful growth has, however, another aspect and affords food for serious reflection ; for is it not typical of what can be done in Baluchistan under careful supervision and is it not a good augury of what may be done in the future in many parts of the country ? The question is one of water, but how many irrigation channels—kutcha irrigation channels—are there in the various districts flowing unprotected through the porous soil under a hot sun ? It is often held that planting trees along an irrigation channel is to be avoided owing to the amount of water they absorb. This is true under certain conditions, but only under certain conditions. In Baluchistán these conditions are not present. The amount of water lost by percolation through the earth channels and absorbed by the rays of the hot sun must be enormous. The planting of trees—trees to provide timber or fuel and trees to yield that exquisite fruit which this land, truly the fruit garden of India, will grow so abundantly would not only prevent so large a loss of water but would utilise usefully the amount which does percolate.

On the subject of the tree growth present in the villages in the vicinity of Quetta on our arrival there, Captain Anscomb writes “ The village of Kansi lying to the south-east of the town was the only village in the *immediate* neighbourhood. It contained orchards of apricot, apple, plum, grape, and mulberry trees ; and there were a few willows, white poplar (*Safedas*) and *Reamer* poplars. The villages of Kirani and Sariab, the former lying about four and a half miles south-west of the town, and the latter about eight miles due south, were well stocked with trees. In Kirani there were mostly fruit trees with a few willows along the water channels and small



Avenue of Kabul Willows on the Jail Road, Quetta.

clumps of mulberries ; while those in Sariab were mostly mulberry and willow with a few apricots. There were very few trees in the Quetta plain when I came (in May 1881), and I believe that to have been the case when the British arrived."

As the planting work continued in the station other species of trees were introduced by degrees, and the avenues, which are mostly to a certain extent mixtures of two or more species, now contain the white or *safeda* (*Populus alba*), black or *kala safeda* (*P. nigra*), *reamer* (*P. sp.*) and *Euphrates* (*P. euphratica*) poplars ; the Kandahar (*Salix alba*), Kabul (*S. aemophylla*) and weeping (*S. babylonica*) willows ; the plane tree or *chinar* (*Platanus orientalis*) ; a species of ash (*Fraxinus sp.*) from America ; elm (*Ulmus sp.*) ; mulberry (*Morus alba*) and apricot (*Prunus armenica*). In addition there are, chiefly in Cantonments, some young horse chestnut (*Æsculus indica*) and robinia (*Robinia pseudo-acacia*).

Running through the station, in Civil Lines and Cantonments alike, is the Lytton Road, the main thoroughfare of Quetta. This road was amongst the first planted, and contains white and black poplars, *chinar*, Kandahar and Kabul willows, young elms and ash. Of these the *chinar* predominates, and the presence of this tree in the avenue renders the latter the most handsome in the station.

By far the most numerous and most prominent trees are the various species of poplars, which have been largely planted. Handsome, upright, well-grown trees these, the only fault to find with which is that they have been planted too closely together, in almost pure avenues in some places, or when mixed, mixed with the shorter Kabul willows.* The Gymkhana Road is planted with a well-grown avenue of white poplar and Kabul willow, the Jail Road with white and *reamer* poplar and Kandahar and Kabul willows. Plate XLVI shows some Kabul willows in the avenue on this road. Both these roads were planted in Col. Gaisford's time between the years 1890—95. Poplars and willows also appear on a part of the Sandeman Road and on the roads within

* Unfortunately both poplars and willows are suffering from a severe attack of a boring Cerambycid beetle, *Aeolesthes sartus*.

Cantonment and Municipal limits. A beautiful avenue, shown in plate XLV, of pure poplar has been planted on the main road running past the Woodcock Spinney, whilst a very typical piece of Kandahari willows may be seen near the Seistan Caravanserai close to the railway station (plate XLIV). The White Road is planted chiefly with ash, which is doing remarkably well both here and in other parts of the station. The trees were raised from seed procured apparently from America. In addition to the two species of willows the ash is to be found on the Brewery Road accompanied by some *Elæagnus* (*E. angustifolia*). Fruit trees have occasionally been used in the avenues as in the case of the Lytton Road and of the Sandeman Road, which is planted with apricots. This is scarcely to be advocated, since these trees never reach the dimensions required for avenue ones. In Cantonments horse chestnut and robinias have been introduced into the roadside avenues to some extent, and these species, especially the latter, whose growth is quite remarkable, promise to do well.

Turning now to the compounds we find that great care and taste have been usually displayed in their planting up. Both in the Residency grounds and those attached to the General's quarters some fine old mulberries point to the existence of this tree in the country at the time of the arrival of the British. In the Residency a considerable amount of white poplar has been planted with Kabul willow, chinar, elms and walnut. These latter are doing excellently, and the tree is one which is well worthy of considerable notice. There are also one or two beautiful species of the *Populus euphratica* here, one of which is shown in plate XLVII. Much the same species are to be found planted in the General's grounds and elsewhere throughout the station. There are a few deodar, which are said to be doing well, and Mr. Hughes-Buller informs me that the flowering of the acacias in the spring gives a touch of brilliancy and brightness to many gardens. The beautiful weeping willow has been planted in several compounds, and notably in the Cantonment garden; with its graceful drooping foliage it greatly adds to the beauty of Quetta's green lawns.



Populus Euphratica in the Residency Grounds, Quetta.

Quetta has long been famed for its splendid fruit, and it owes its reputation in this respect almost entirely to Sir Stanley Edwardes, who was practically the first introducer of the fine varieties of trees now to be found in the station. On this subject he has given me a perfect mine of information.

The white mulberry, apricots and grapes were the chief, if not the only, fruits to be found round Quetta on the arrival of the British. Mr. Hughes-Buller informs me that nineteen varieties of grape are known in the district. He is doubtful as to whether British enterprize has, as yet, done anything for viticulture. Sir Stanley obtained 200 fruit trees from Rivers & Sons, the well-known English firm of fruit-growing stock. These consisted of peaches, nectarines, plums, apples, pears and cherries ; in addition there were also gooseberry, currant, strawberry and raspberry plants. Sir Stanley gave half of the trees received to the Political Department and planted the rest in the General's compound. The following history of the trees is from his own pen : "Two plants of each sort were sent, and I managed to rear one of each and of some two—of the bush fruit a dozen of each were sent. The box 9'×4'×3' arrived at Karachi a little late in March. I had it sent to Sibi at once and up the Bolan by bullock dák. The trees and plants had all begun to sprout, which I expected, so I had made preparations—holes dug and matting protection like extinguishers. On the box being opened the trees had white leaves. We planted them during the night and placed the covers over them. By degrees the leaves turned yellow and light green, and when they were of normal colour the extinguishers were taken off. Thus one lost very few." These trees have prospered amazingly, and Sir Stanley in later years received eloquent testimony as to the delicious delicacy of the flavour of their fruit from Sir George White and Sir Donald Stewart, both of whom followed him in the Quetta Command (Sir Donald was in Command of the Southern Afghanistan Field Force, of which the Quetta Garrison formed part) which he was himself the first to hold. Sir Stanley was also responsible for the introduction of a high class potato. "I told Rivers & Sons," he says, "to get some good sort of

potatoes, cut them in half and nail them on between the air holes in the side of the box, which they did. The potatoes were sprouting when they arrived, and I planted them and got a splendid crop—also seed, which I distributed."

At the time of planting out these English fruit trees Sir Stanley laid out an orchard of indigenous stock on which he intended grafting from the English trees. Owing to a transfer to Bombay he was not able to carry out this intention, but his idea was not forgotten, and grafting on a considerable scale has, and is, being carried out in Quetta and the neighbourhood. Since this note has reference to the station of Quetta only it would be out of place to deal here with the fruit gardens of Baluchistan, a subject which, it is hoped, it will be possible to treat of at a later date. It may be mentioned, however, that the grafting operations have met with conspicuous success, and amongst other interesting operations the European mulberry has been grafted on to the indigenous species with excellent results. So favourable is the Baluchistan climate to these methods that it has recently been proposed to endeavour to graft the valuable Italian olive on to the indigenous variety which forms a part of the forest growth of Baluchistan.

The initiation of these operations for improving indigenous stock may be said to be largely due to the efforts of the late Colonel Gaisford. Mr. Hughes-Buller writes "A great deal was done for arboriculture and horticulture by the late Colonel Gaisford, who devoted great attention to the subject. He obtained fruit trees from America, Saharanpur and Naini Tal, and got orders issued that when *tahavi* advances were made for opening up new sources of irrigation the grantee should be obliged to plant a certain number of trees along the water channels."

In taking leave of the beautiful avenues and fruit gardens of the station of Quetta we would offer the sincerest congratulations to those to whose public spirit their formation is due and to their equally energetic successors, who have carried on the work with such excellent results.

TEAK DIBBLINGS: WHY ARE THEY A FAILURE?

BY R. S. TROUP, F.C.H.

For many years it has been the custom in some of the Divisions of Burma to carry out "dibblings" of teak seed in selected open localities in natural forest, with a view to obtaining teak reproduction artificially.

These dibblings consist in depositing teak seeds in shallow holes in the ground and covering them lightly with earth. The soil is usually not prepared in any way, and the dibblings are as a rule carried out in June.

In the vast majority of cases complete failure has resulted. This is often due to the selection of areas where the ground is not sufficiently exposed to the heat of the sun, but there are two other important considerations to which due prominence has seldom been given. These are (1) the season of sowing; we almost invariably sow too late, whereas we ought to sow well before the first showers, that is, by the middle of April; (2) the preparation of the ground; better results than those now obtained will probably be got by burning the leaf covering, hoeing the ground before sowing, and lightly covering the seed after sowing. These points were brought out by an experiment which I carried out in 1904 at Tharrawaddy, and which but for a transfer, I had intended continuing.

The object of the experiment was to ascertain the most successful means of inducing the germination of teak seed not previously treated in any way. For this purpose eight adjacent plots were marked out *in the open*, to obtain the full effect of the sun's heat for germination, and light for subsequent growth. In six of the plots sowings were made, 100 seeds in each plot, on the 13th April; that is, before the first showers. These plots we may call A, and the manner in which each was treated is given below. In the remaining two plots sowings were made on the 23rd June, that is, after the rains had well set in; this is about the time when "dibblings" are usually carried out in the forest. These latter two plots we may call B.

The method of treatment of the plots A, and the results, were as follows :—

Method of preparation of soil and sowing of seed.	Number of seeds germinate up to date (per cent).			
	18th June.	24th June.	17th July	
Area burnt (about 3" layer of leaves)	Soil not prepared ... Seed sown broadcast and not covered ..	26	27	28
	Soil loosened with hoe ... { Ditto ... Seed sown broadcast and lightly covered ...	32	43	47
Area not burnt sparingly covered with dry short grass at time of sowing.	Soil not prepared ... Seed sown broadcast and not covered ..	67	75	81
	Soil loosened with hoe ... { Ditto ... Seed sown broadcast and lightly covered.	Nil.	8*	11
	Soil not prepared ... Seed sown broadcast and not covered ..	19	21	25
	Soil loosened with hoe ... { Ditto ... Seed sown broadcast and lightly covered.	42	42	44

By July the state of the weed growth on the plots was as follows :—

(a) Plots burnt and hoed up—a fair amount of grass, etc., but the teak seedlings well above it, owing to the late start of the grass and other weeds.

(b) Plots not burnt, but hoed up—more grass, etc., but the teak struggling successfully.

(c) Plot burnt, but not hoed up—somewhat similar to (b), but rather more grass and weeds.

(d) Plot not burnt, and not hoed up—tall grass and weeds, killing out the teak seedlings.

* Of these three damped off in the grass soon after germinating.

These plots A were unfortunately destroyed by accident towards the end of July, and the further history of the young teak during the rains could not be followed.

Turning to the plots B. On one plot, not prepared in any way, seed was sown broadcast and not covered ; on the other the usual "dibblings" were imitated, that is, the seed was placed in shallow holes and lightly covered. These sowings were made on the 23rd June. On these plots not a single seed germinated throughout the rains : this I attribute to two main causes—(1) the seed did not get the benefit of the alternate heat and moisture at the beginning of the rains which is so essential to successful germination ; (2) the soil was not prepared in any way. Even if the seed had germinated the seedlings would have had a much harder struggle against weeds than those in the plots A, which were well on by July.

These experiments are, of course, very incomplete, and to be of much value they would have to be repeated again and again to eliminate any abnormal results which might appear in a single trial. As it stands, however, the experiment appears to bring out the following facts (assuming the essential condition that teak sowings must be carried out in fairly open localities, and not under dense cover)—(1) sowings should be carried out in April, before the first showers, and not in June, as is usually done ; this gives the seed the benefit of alternating heat and rain, and gives the seedlings a start of the weeds ; (2) burning, loosening the soil, and lightly covering the seed gives the best results, the other methods attempted being all considerably less successful.

The question of teak sowings in forest areas is a difficult one as well as a most important one ; the operation has, however, so far as my experience goes, never met with much success. It would be interesting to know the results of other experiments bearing on the subject, or of cases, with details of the methods employed, where such sowings have been successful. So far it appears that our somewhat costly *taungya* system is the only one on which we can place reliance.

A few years ago Ranger Maung San Lon carried out, on his own initiative, in the Mokka Reserve, Tharrawaddy Division,

an experiment which has proved remarkably successful, and which deserves further trial. He cleared and burned a small patch on an opening at the side of a fire-line, and in this patch he planted, 2' × 2', pieces of the root stocks of young teak plants dug up in the surrounding forest, trimming off the stem and the lower part of the taproot. Owing to the density of the planting, little or no tending has been necessary since the first two years, as the shade of the teak plants has kept down weeds. The growth of the teak on this patch, which I have visited from time to time, is remarkably good. Doubtless the shoots from the root stocks were in their first year more vigorous than is the case with seedlings, and this would give them an early start over the weed growth. This method of extending teak reproduction certainly commends itself to further trial in Burma.

MIXED SAL FORESTS AND FIRE-PROTECTION.

BY C. C. HATT, I.F.S.

One of the chief difficulties perhaps in dealing with some of the mixed sal forests of North-Eastern Bengal and Assam, which appear to have grown up under conditions widely different from those which now prevail, is to arrive at an approximate conception of what those conditions may have been. As far as can be gathered from evidence now obtainable in the forests and from reports dating back some thirty odd years, one of the chief factors which has tended to bring about these changed conditions would appear to have been fire-protection, and an interesting point arising in this connection is that the present condition of portions of some of these forests tends to force the conclusion that had these areas never been subject to periodical fires the regeneration of the sal would not have been so successful as it has been. It also appears possible that such a favourable opportunity for the regeneration of the sal, as occurred at the time immediately following the inception of successful fire-protection, may never occur again unless a means of reproducing artificially a sufficiently close approximation to those conditions without undue damage to the standing crop can be discovered.

A somewhat similar condition of things in some of the teak forests in Burma may have given rise to what has been, perhaps somewhat gratuitously, referred to in the pages of the *Indian Forester* as the "Burma School," upholding as its device the motto that fire's are good for teak forests." But to one who has spent several years in certain classes of forest it does not seem to be an entirely unreasonable conception that there may be conditions in which fire might be usefully employed in facilitating regeneration and possibly also in assisting advance growth when the most valuable species happens to possess the highest fire-resisting capacity.

The enormous cost of and practical difficulties met with in endeavouring to carry out by hand such weedings and extermination of creepers as appear to be necessary to enable the young sal to win through over large areas in these mixed sal forests are circumstances which naturally tend to make a Divisional Officer look round for some other means of attaining his end, and he may be excused for refusing to believe that because fire has proved such a bad master it must also necessarily be an equally bad servant, and that the last word has been said on fire-protection in this connection.

THE EFFECTS OF THE GREAT FROSTS OF 1905 ON THE FORESTS OF NORTHERN INDIA.

VI.—THE EFFECTS OF THE FROST IN THE DECHAURI RANGE,
KUMAUN, U. P.

BY GANGA NARAYAN DIKSHIT,
FOREST RANGER, KUMAUN DIVISION.

The severe frost of last winter was not alone fatal to the cereal crops, but it told upon the forest vegetation as well.

The following note was made upon the damage done to the trees which suffered in the Dechauri Range of the Kumaun Division :—

(1) As soon as the frost set in the foliage of *Buchanania latifolia* began to wither up, and as the frost became more intense the hardier species began to dry up, until not a single species save khair and sissu were left unaffected in the low-lying places and

valleys. Forests situated on higher levels and ridges of mountains were affected less because on these only young saplings and not poles and mature trees fell victims. When the dried foliage dropped from the trees at the commencement of the summer season, it made the forest like tinder and ready to catch fire even at the slightest accident. For this reason the fire-protection has been more intense this year, and the Rangers and Forest Guards had to be alert at their work of patrolling the forest.

Now that the rainy season has commenced a number of the injured trees have obtained new life and foliage, but still hundreds of trees show no signs of reviving, having been killed outright.

(2) Even the trees which have revived are retarded in their growth. This I found out by comparing the results of measurements of sample plots for this year with those of the previous years.

(3) The produce from honey has been much less. In localities from which maunds of honey were extracted in previous years hardly seers could be found there this year because, firstly, millions of bees died owing to the severe frost; secondly, the flowers out of which honey would have been extracted dried.

(4) The production of Rori (the red powder from the fruits of *Mallotus Philippensis*) has suffered in the same way because the fruits on the trees dried and fell down.

(5) The export from myrabolans has been very small. The fruit of this tree suffered so heavily that even the monkeys found it hard to fill their stomachs with it.

Honey, Rori, and myrabolans are the important and valuable articles of export which pay back the contractors of Keranamal the price which they bid in auction. Hence these articles having been killed outright by the frost the contractors of Keranamal are heavy losers.

While marking in the different ranges of the Ganges Division during the whole of the winter season and while looking after the fire conservancy of Fatehpur Range in the Kumaun Division, I have been carefully noting these injurious effects of the frost on the forest vegetation.

14th August 1905.

CORRESPONDENCE.

EXPLANATIONS AND MORE IMPORTANT MATTERS.

Personal.—The delay of several months* between the writing and the printing of my recent contribution has in the case of Mowra put me into a false position. Before my remarks on page 269 came out Government were pleased to order the collection of Mowra seeds departmentally. I am thus in the position of condemning the orders of Government, whereas at the time of writing I had no expectation that the collection would be ordered.

Treatment of Sal.—In the June number Mr. Channer has a very good article on this subject, in which he says on page 328, "Mr. Gleadow finally stated that the method was only suitable to complete and uniform crops, though I see no reason why it should not be applied to a properly stocked irregular crop under the selection system." Quite so. I can only infer that my use of the word "*uniform*" led some to imagine that it referred to forests worked under the "Uniform" or "Regular," or "Shelterwood Compartment" or "Natural Regeneration with Thinnings" Method. I do not think this inference necessarily follows from anything preceding. Mr. Channer's "*properly stocked irregular crop*" is as a matter of fact *complete* and should be as far as possible "*uniform*" in its irregularity. We agree on the fact, though I perhaps used an ill-chosen term. The relation discovered by Mr. Channer between "selection" and "storeys" is a true and correct one. On the other side is another relation, *viz.*, that between "storeys" and "coppice with Standards." By increasing the standards over coppice we can convert to "storeys." This relation has an important practical future before it when the time

* We regret that some delay is unavoidable in publishing MSS. owing to the increase in the material now sent in for publication. We trust our correspondent will look upon this as a good sign, since it proves the interest taken in the Magazine.—HON. ED.

comes to restore some of our wholesale-scale coppices to their proper status.

Fire-protection.—Notwithstanding the conversion of colleagues whom I know to be good and true men, it is still incomprehensible to me* (with my limited experience) how any kind of forest fire, worth calling a fire, can be good for teak seeds. I have examined the fallen seeds after the passage of our lightest fires, and found them nearly all cooked. Many others must be in the same case (not cooked, but ignorant). I therefore venture to ask those whose experience is different to try and show us wherein the difference lies. One very useful step towards this end would be to print tables of average monthly rainfall for the forests in question and to supplement this with a short description of the soil, the soil covering, and crop. Here, even our "evergreen" forests get no rain beyond an accidental shower between November and June. Throughout the Northern and Central Circles of Bombay fires are most certainly injurious.

Water-study.—May I ask those who have the means to note the depth of water in any wells which can be periodically read. Of course a bench mark should be cut on one of the masonry courses, and equally of course the depth should be taken in the early morning before the people begin to draw their supplies. Mr. Pearson has noted a curious fact, *viz.*, that certain wells held more water last May than they did in April, though no rain had intervened. There are two important facts that may or may not be correlated. Under a fiercer sun the atmospheric dryness is often less, and life more endurable, in May-June than in April. Trees often do not wait for the rains to put forth their new crop of leaves. A few begin in the early spring and hot weather; others, as teak for instance, begin when the atmosphere loses its extreme dryness about May-June (the monsoon arriving June-July). It seems to be principally an affair of the species and temperature; but that explanation is not final. I much regret having no records of well-measurements dating consecutively from before the late famine years. The subsoil water in the country is certainly dangerously low; if it gets much lower large tracts will be

added to the desert areas, and it is to be feared permanently. Disforestation is all very fine during the fat years, but Nemesis comes later.

F. GLEADOW.

Fires and Game—When our pleasures are in question it is very hard to keep a steady eye on the pursuit of truth alone. In the June number is an important article on Game and Grass-burning, but it is not always clear what statements are those of the Editor, and which are adopted. In any case I do not think the piece of bathos quoted at the beginning is likely to assist in forming a judicial opinion. The article raises two important questions—(1) whether fire-protection reduces the head of game; (2) whether fires destroy the finer grasses. I do not believe for a moment that fire-protection makes any difference to the head of game, though it does to the sportsman. Game loves tender young grass out of season just as much as your sportsman loves fruits and vegetables out of season. Consequently the sportsman finds his game easily in burnt areas. Sambhar are essentially *browsers*, so do not let the greater difficulty of approaching them in unburnt jungle lead us to state that they are being starved out for want of early asparagus.

The destruction of the finest grasses by continual firing I have always held and still hold to be a fact, though there are possible exceptions in the case of individual species. The real reasons for burning are two: firstly, the production of young shoots at a time of difficulty when the country generally is dried up; secondly, the toughness of the existing grasses themselves. These continually-burnt areas produce grasses so coarse that some of them can only be eaten while they remain young. As they mature, even the buffaloes can make nothing of them. It is only natural that the herdsmen should be keen on burning. Let them burn their own pastures as much as they like, but let us remember that forests have to be managed under the rules of sylviculture, not those of pasture-production or game-raising. The rules of sylviculture require the presence of humus. The burning of the humus involves the loss of about 80 per cent of the most precious fertilisers, and the retention of only about 5 per cent as ash.

MERCER'S TABLES.

Owing to a fresh demand having arisen for these tables the Manager of the 'Indian' Press, Allahabad, has been accorded permission by Mr. Mercer to print a fresh edition on his own responsibility and at his own risk. All orders for these tables should therefore be addressed to the 'Indian' Press.

The following correspondence on the subject between Mr. Mercer and the Press Manager has been received for publication:—

No. 110, dated 22nd June 1905.

From—L. Mercer, Esq., Conservator of Forests, Central Circle
United Provinces,

To—The Manager, ' Indian ' Press, Allahabad.

Sir,—I am in receipt of your letter of the 17th June. I give you full permission to print and issue a fresh edition of my tables provided that you sell them at Re. 1-8-0 per copy or less for English, and Re. 1 a copy or less for Urdu tables: and also provided you insert a preface explaining that although you have my permission to issue a fresh edition you are doing so entirely at your own risk, and that I am in no way responsible for any errors that may creep in. A list of errors in the present tables may be found at the end of the *Indian Forester* for November 1903, a copy of which is, I believe, to be obtained from the 'Pioneer' Press.

2. The tables in Hindi were printed at the Government Press. The selling price I fixed was Re. 1-6-0, and if you print the tables in this character your price should not exceed Re. 1-8-0.

From—The Manager, ' Indian ' Press, Allahabad,

To—L. Mercer, Esq., Conservator of Forests, Central Circle,

Naini Tal, dated 26th June 1905.

Sir,—We are much obliged for your No. 110, dated the 22nd instant, and beg to thank you for your kindly giving us your permission to print and publish a fresh edition of your tables. We agree to carry out all the instructions conveyed in your letter under reply.

REVIEWS AND TRANSLATIONS

PROGRESS REPORT OF FOREST ADMINISTRATION IN THE UNITED PROVINCES FOR 1903-04.

The above-mentioned report continues to show satisfactory evidences of progress in works of improvement, coupled with a maintenance of gratifying financial results.

The Local Government appear fully to appreciate the necessity to efficient management of good and adequate accommodation for all members of the establishment, and would almost seem disappointed that the expenditure on new roads and buildings was smaller than in the preceding year.

They are of opinion that more money might still be spent with advantage under this head.

Were money more generally allotted to this purpose in other Provinces, there is little doubt that with improved health there would be a corresponding increase in activity and efficiency throughout the entire staff.

There are 375 square miles of reserves for which working plans have still to be made. These are for the most part small areas scattered throughout different divisions.

Bundelkhand is the exception. Here 269 square miles, that is to say the whole area of the Division, still remain to be dealt with. A plan is, however, at present not required.

Rupees 29,560 were spent on new buildings and Rs. 17,935 on new roads.

Mere figures, however, tell us little, unless results for previous years, and for other Provinces, are available for comparison. Turning to financial results the gross revenue of Rs. 6,40,861 in Jaunsar Division strikes one as very high for an area of 142 square miles of reserves and 153 square miles of leased forest. The charges in this Division amounted to Rs. 3,37,410.

Jaunsar is now the only Division in these Provinces where departmental sawings of sleepers are carried on, an indent of a

lakh of sleepers being yearly supplied to the Rajputana-Malwa Railway.

If the improvement in rates, mentioned as offered by purchasers, continues, it is a matter for consideration whether this sleeper indent might not equally well be supplied by contractors who would buy the trees standing. A great saving in charges would accrue to the department with, it is conjectured, the almost invariable accompaniment of an increased surplus.

The report is in fact a record of successful and energetic management.

REVIEW OF FOREST ADMINISTRATION IN ASSAM, 1903-04.

The total area classed as State forests at the close of the year was 28,287 square miles, of which 3,778 constitute reserve forests, whilst the remaining 18,509 square miles are unreserved jungle and waste. No important addition was made to the reserved forests and no land was formally disforested during the year. A special examination, however, was made over an area of 600 square miles comprised in the Nambor and adjoining reserves in the Sibsagar Division with a view to throwing open to settlers portions in which the timber is of little value but which are suited to ordinary cultivation. This tract of country is now traversed by the Assam-Bengal Railway, and it is desired that its colonisation should be encouraged. As a result the Chief Commissioner has decided that an area of about 100 square miles shall be thrown open to cultivation.

Survey operations on the 4-inch scale were carried on in the Kamrup and Nowgong districts, an area of 160 square miles being covered. The Resolution states that the Chief Commissioner is doubtful of the wisdom of spending large sums of money in surveying forests which have not as yet been brought under systematic management. It may be pointed out that without good maps it is impossible to frame working plans for forest areas.

Progress in the preparation of working plans advanced but slowly during the year. The revision of the Goalpara working plan

taken in hand in 1901-02 was not completed. A revised scheme of felling, based apparently upon an enumeration of over 7 per cent of the area, was submitted with the request that the provisions for the next two years might be sanctioned, pending a further redistribution of coupes. The Inspector-General sanctioned the proposals, but laid down that the enumeration would have to be made over a larger area than 7 per cent. On this fresh proposals have been submitted based, we read, upon the fact that enumeration is very difficult. The provisions of the Dambu working plan in the Garo Hills Division, which expired at the close of 1901-02, it having been found impossible to carry out the provision laid down of felling the 8,000 trees prescribed 18 years ago, are to be acted upon so long as the demand for sleepers for the Eastern Bengal State Railway continues. Only 4,546 trees were felled during the period of the plan. The provisions of the Darugiri working plan will now also be followed as sleeper operations will be extended to the Darugiri reserve during the next cold weather. The Sibsagar working plan was framed as a preliminary report for the Nambor reserve to meet the demand which has arisen for sleepers for the Assam-Bengal Railway. The plan was, however, considered too elaborate for a preliminary one, and is now to be printed and submitted for sanction as a full-bodied working plan. Simple plans were drawn up, or work was taken in hand to enable them to be drawn up, for the Cachar, Nowgong, and Lakhimpur Divisions.

A sum of Rs. 12,846 was expended on 26 miles of new roads and repairs to 172 miles of existing ones. We are glad to note the satisfactory increase on new buildings (Rs. 4,373 as compared with Rs. 2,667 of the previous year), but this sum still appears ridiculously small when the great importance of efficiently housing the staff in order to obtain from it its best work in such a climate as Assam is considered.

Protection from Forest offences shows an improvement. We note that 75 per cent of the cases taken into Court resulted in convictions. The area over which special protection from fire was attempted was 996·5 square miles. Of this area 991·2 square

miles were successfully protected, a most satisfactory result. Rupees 7,737 were spent on this protection. One hundred and ninety-six square miles were partially protected and remained unburnt. The report does not state of what this partial protection consists, but as a portion of it apparently applies to the Bhutan frontier, we agree with the Conservator that it cannot be considered sufficient in that direction. Any one who has had experience of the danger a forest situated on the frontier of this State is liable to from fire would consider every rupee spent on protection money well laid out, and more especially when the forests are such important ones as the Goalpara sal forests and the Bijni reserve.

Grazing is not a *bête noire* in the Assam forests and, *rara avis*, no cattle were impounded in the Circle during the year under report.

Natural reproduction of sal was reported as profuse from the divisions in the centre of the Province, but was not so in the Goalpara and Garo Hills divisions to the west. The natural reproduction from *Nahor** in areas felled over was satisfactory.

Natural reproduction of simul (*Bombax malabaricum*) is reported as very profuse in Goalpara and Lakhimpur east and west, and the Conservator has observed the same elsewhere. Fire protection appears to be all that is required to ensure full crops of this timber, for which there is a large demand for tea boxes in the Province. Areas are to be taken up for the protection of this tree where it can be easily brought to market.

The receipts from regular plantations amounted to Rs. 15,697, practically all derived from rubber plantations, the expenditure received being Rs. 6,8c9 and the total area under plantations 3,285 acres, of which 3,222 acres are under rubber. The rubber plantations are at Kulsí in the Kamrup Division and Charduar in the Darrang Division. An extension of 1,000 acres of the Charduar plantation had been sanctioned by the Government of

* As an Editor we would suggest the advisability of giving the scientific terminology of the trees in addition to the local, which convey nothing to the non-provincial Forest Officer and to the non-forest reader. The value of the interesting remarks in Circle Reports is thus often lost to the reader.—HON. ED.

India, but it was found possible to only complete 75 acres. Rubber trees were tapped in both the Kulsi and Charduar plantations 1,294 lbs. of rubber from the Kulsi and 2,986 lbs. from the Charduar trees being obtained.

Trees felled departmentally by purchasers in reserved forests are felled under the selection method in all divisions except in the Inner Line reserve of the Cachar Division. Selection felling in the proper sense of the term is only carried out in the Goalpara Division and in some reserves of the Garo Hills where the forests are systematically worked under plans, but in other divisions the selection of trees is made by the purchasers themselves, who generally remove the biggest and best matured trees over 4½ feet in girth. There is no limit to the number of trees that may be taken from reserves, but as the demand is by no means great, there is no fear at present of overworking the forests. In some divisions where this system exists reserved areas have been roughly divided into smaller ones, and rough plans drawn up for limiting fellings to certain portions only in each year till they appear to contain no more mature trees. This should be done in all divisions where regular plans are not in existence for reserves. Three thousand eight hundred and sixty-four sal trees were felled in the Goalpara Division and converted into sleepers, practically the whole of the work being done departmentally. The fellings in the unclassed forests, the Inner Line reserve, and the Lushai Hills were unregulated.

The value realised from grazing in the Circle amounted to Rs. 88,346 against Rs. 88,250 in the previous year. All minor produce with the exception of plantation rubber which is tapped departmentally was collected and removed by purchasers and free grantees. The revenue from elephant tusks forms an exception to this rule as they are taken possession of by Government and sold and a reward of from 5 to 10 per cent given to the finders. In the Goalpara Division we note that an experiment is to be made in the cultivation of lac in the Bijni unclassed State forests. It is curious to read that the Cachar Divisional Officer has made arrangements to supply bamboos suitable for tent poles to the

Rangoon Arsenal. Surely Burma, as has been suggested, could supply this demand, and thereby save the heavy freight.

Practically the whole of the sleeper work is done by departmental agency, and as is mentioned in the report considerable sylvicultural gain has accrued since purchasers will only take the mature good sound trees, leaving the crooked and broken ones standing in the forest. When the work is done by the department all these are removed as well as the sound trees ; the operations are thus of the nature of cleanings. The sleeper demand is thus aiding in sylviculturally improving the crop in the Assam sal forests. The result of departmental operations shows a satisfactory increase of 90,707 cubic feet of timber removed and 14,515 cubic feet of fuel, the increase being due to the sleeper operations. The six miles of tramway in the Goalpara Division greatly facilitated the operations.

The estimated total value of free grants given is Rs. 4,51,309. The amount realised from rubber during the year was Rs. 80,358 or Rs. 38,722 more than in the previous year, due chiefly to larger imports of foreign rubber into the Lakhimpur Division. The revenue for the year amounted to Rs. 6,76,944 as against Rs. 5,91,087 of the preceding year or an increase of Rs. 85,857 ; the surplus was Rs. 2,25,057 as against Rs. 2,44,765 of last year ; the expenditure was Rs. 4,51,887 as against Rs. 3,46,322 in the previous year, the increase being chiefly due to expenditure on sleeper operations, tapping of rubber at Kulsí, etc.

The labour supply has been a serious difficulty in Assam, and we read with considerable pleasure that forest villages are being formed in culturable areas within the reserves. The Local Government has decided that even in reserves containing considerable areas of cultivated land such as in Cachar and Sylhet settlements of people larger than the ordinary forest village should be made under the control of the department so as not to disturb the boundaries of the reserves and cut them into unworkable blocks. We believe that this forest village system will do more than anything else to popularise the department with the agricultural population and lead them to take more interest in the protection of forest areas situated in their neighbourhood, whilst at the same time

it will lighten the labour question for the Forest Officer, and, more important still, stop large destructive fires, since with forest villages scattered through the forest it will be an easier matter to collect hands to check and stamp out a fire before it has got a complete hold of an area.

Amongst the other heavy work put through we note that Mr. Carr, the writer of the report, and his officers were able to find time to supply botanical and economic specimens to the Imperial Institute, London, and Indian Museum, Calcutta.

CURRENT LITERATURE.

PROCEEDINGS OF THE AMERICAN FOREST CONGRESS.—In our leader in the April number (p. 183) we drew attention to the important Forest Congress held in Washington at the beginning of this year. We have now been favoured with a copy of the Proceedings of the Congress embodying the papers read at the several meetings. This is a handsome little volume, both paper and type being excellent. It is divided into seven parts entitled Forestry as a National Question, Importance of the Public Forest Lands to Irrigation, the Lumber Industry and the Forests, Importance of the Public Forest Lands to Grazing, Railroads in relation to the Forest, Importance of Public Forest Lands to Mining and National State Forestry Policy. Each of these parts deals with the papers read. We trust to be able to reproduce extracts of some of these which have a bearing upon forest questions in India.

THE SCOTTISH GEOGRAPHICAL MAGAZINE for August contains an interesting article on the Scottish National Antarctic Expedition written by the Leader of the Expedition, Mr. W. S. Bruce. A short introduction is followed by a description of the various soundings taken in the Atlantic Ocean, both written by Mr. Bruce. Mr. J. H. Harvey Pirie then gives a paper descriptive of the South Atlantic Ocean and Weddell Sea, which is followed by one on Meteorology by R. C. Mossman, and a fifth on Diego Alvarez or Gough Island. This latter is of considerable interest since, as the author remarks, it is somewhat remarkable that an island lying in so low a southern latitude as the Cape and almost in the track of sailing ships

outward bound *via* the Cape of Good Hope should have remained practically unexplored until the present. A rich collection of biological treasures was made upon this island. The articles contain some most interesting illustrations, and there is a map of Gough Island.

We have received a copy of the ADMINISTRATION REPORTS for 1904 of the EXPERT STAFF OF THE ROYAL BOTANIC GARDENS IN CEYLON. Commencing with a note upon economic products and experiments made with them by the Director, Mr. J. C. Willis, the little volume contains the reports of the Entomologist, Mycologist, Controller of the Experiment Stations, and the Superintendent of Cotton Experiments, which are all of considerable interest.

FORESTRY AND IRRIGATION for July deals to a large extent with Forestry and Forest Questions in Connecticut. There is also an interesting article on the effect of forest cover upon stream flow by Mr. W. B. Greeley. This deals with a study of drainage conditions in the Catskill Mountains.

THE TROPICAL AGRICULTURIST has recently changed its management, and after being carried on so ably by Mr. Ferguson, has now become the Magazine of the Ceylon Agricultural Society and is edited by Mr. J. C. Willis. The August number contains some interesting articles on rubber, including a historical note on the introduction of Para rubber into Ceylon and the East. In another note we read that Ceylon has, or will have by the close of the year, 39,140 acres under rubber, the total area outside Ceylon taken from the report of the United Planters' Association for the Straits, 1904, being— .

Malay Peninsula	...	...	...	30,000 acres
Java	...	...	...	5,000 "
India and Burma	...	...	...	5,000 "

THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES also contains notes upon Para rubber, including a short note on a fungus on the leaves which causes pale blotches and is said to be a species of *Cercospora*. There are also some remarks on fibres.

SHIKAR, TRAVEL, AND NATURAL HISTORY NOTES

A TREATMENT FOR HYDROPHOBIA.

I send you the following curious prescription for the treatment of hydrophobia I received from a native of India, or more particularly of the Deccan.

Firstly, clean and cauterise the bitten part; then keep the wound open by applying linseed poultices.

For *internal administration*.—Take a handful of green leaves of the wild babul (Hind. *Divana babul*, Telugu *Muki ahumab*) wash well and pound in a clean mortar. Add a sufficient quantity of water to produce, when strained through clean muslin, about a wine-glassful of juice. Dose for an adult one wine-glass; for a child, half this quantity of the strained juice.

Give for three days on an empty stomach in the morning and one hour before the evening meal.

Diet.—Sweet "tire" or curds (Hind. *chakka dhyn*) and rice or wheat cakes, prepared without fat, i.e., ghi, or salt.

No stimulants whatsoever to be given during this period. If desired, weak tea may be allowed. If the patient is of nervous temperament and affected by cloudy weather repeat the dose as above for three days and diet as directed.

If on administering the decoction of the leaves the patient is apt to vomit, a tablespoon of sweet tire (*chakka dhyn*) will be found useful.

* * * * *

I have not been able to find out which of the acacias goes by these names (Wild babul, Hind. *Divana babul*, Tel. *Muki ahumab*) and have referred to Brandis' and Kanji Lal's "Floras of the North-West Provinces and Oudh" and also to Cameron's "Forest Trees of Mysore and Coorg" without determining it. Could you, or any of your readers, should you think fit to insert this in your estimable monthly, give me the scientific name of this species?

My informant further told me that the pods are short and crooked and when dry are of a dark brown colour.

R. D. HUDSON.

EXTRACTS FROM OFFICIAL PAPERS.

FIRE PROTECTION IN MADRAS.

[The following papers on the subject of fire protection in the Madras Forests will, we think, prove of considerable interest to our readers.—Hon. Ed.]

Resolution—Forest No. 76, dated 24th March 1905.

(2) In March 1902 Mr. A. W. Lushington, District Forest Officer, North Coimbatore, in a long and strongly worded note to the Collector, brought to notice the terrible destruction of the forests in the division by annual fires which threatened the supply of water in the Cauvery. He pointed out the insufficiency of the sanctioned punitive measures as deterrents and the urgent need for taking energetic action in the matter. Sixty per cent of the fires in the North Coimbatore Division were ascribed by him to wilful incendiaryism by graziers in order to obtain new grass, 30 per cent to the hill tribes (the Sholagars) for the purpose of enabling them to find out minor produce, and 10 per cent to carelessness of travellers and bandymen passing along cart-tracks, paths or streams in the jungle. In order to check these fires Mr. Lushington urged the entertainment of a larger establishment, the cutting and clearing of permanent fire lines so as to be easily convertible into cart-tracks and roads, and special legislation to fix responsibility on the ryots of villages within a radius of 20 miles of the scene of any fire. The Board, however, considered the suggestions of Mr. Lushington to be too vague, and called * on him to devise more practical measures of protection. The Board at the same time suggested that some attempt should be made to influence public opinion in the villages concerned and to secure the co-operation of the purchasers of minor forest produce and that of the local revenue officials in the matter.

3. Mr. Brasier, the late acting Conservator of Forests, Southern Circle, in submitting for orders a similar note by the

* Board's Proceedings, Forest Mis. No. 113, dated 9th March 1903.

District Forest Officer, Madura, urged that the hands of District Forest Officers should be strengthened by entrusting to them the powers of closure which had been delegated to the Board in Government Order No. 141, Revenue, dated 6th February 1902. In this opinion he was supported also by Mr. Cardew, then Collector of Madura. The Board, however, was not * then in favour of further delegating these powers; it held that the closure of forests to grazing was a drastic form of punishment and that the punishment of increasing the rates of grazing fees, suggested in the papers disposed of in Board's Proceedings, Forest No. 67, dated 9th March 1903, recorded in Government Order, No. 402, Revenue, dated 22nd April 1903, was preferable to total closure. In the meantime the Collector of Coimbatore (Mr. Bedford) made yet another suggestion. He pointed out that steps were being taken to divide the unwieldy forest reserves in North Coimbatore into compartments or grazing blocks of 3,000 to 5,000 acres in extent, and suggested that, whenever a compartment was fired, the permits for grazing therein should at once be cancelled and be only renewed on payment of double fees, the fees being again doubled each time a fire occurred in the block. In recommending this suggestion Mr. Bedford also proposed that power should be vested in the Collector himself to issue the necessary orders in the matter, a report being simultaneously submitted to the Board, as, in his opinion, speedy punishment had double the effect of a deferred punishment.

4. On a perusal of these reports the Board considered that the whole subject of fire protection and the most suitable penalties for incendiarism require further careful consideration, and, accordingly, requested the three Conservators to submit their views on the question after consulting the Collectors and District Forest Officers.

5. The views and suggestions of the various officers consulted as to the best means of preventing fires and punishing incendiaries are contained in the papers read above. The variety of the recommendations made is no doubt striking, but is not, in the Board's opinion, to be wondered at since the conditions of the problem vary greatly from district to district, and the measures to

* Board's Proceedings, Forest Mis. No. 212, dated 8th April 1903.

be adopted must depend on local conditions. The preventive measures suggested, which require notice, are enumerated below—

- (a) to clear and fire trace all boundaries (both forest and district boundaries) a also all admitted rights of way and paths connecting camping grounds with each other or with villages outside the forest boundary;
- (b) to have a network of exterior and interior fire lines, to isolate or localise the fires and to open up the forests by paths and roads so as to admit of all paths being easily reached;
- (c) to increase the number of fire patrols and employ them permanently throughout the year;
- (d) to divide the forests into small, compact and manageable blocks, so that, when required, the areas may be closed effectively and without hardship to the people;
- (e) to limit the felling and exploiting season to six months in order that the establishment may devote its full energies to fire protection during the dry season;
- (f) to house the fire patrols in the forests themselves by providing them with huts on fire lines or on ridges commanding a view of the surrounding forests;
- (g) to close special areas to grazing during hot weather and encourage hay-making in those areas;
- (h) to empower the District Forest Officer to manage the grazing grounds on the same commercial principles as he regulates the sale of other produce;
- (i) to prohibit the penning of cattle in the forests from 1st March to 1st September of ever year;
- (j) to burn departmentally early in the fire season the most grassy parts of the reserves so as to offer graziers no inducement to burn the forests;
- (k) to dispense with the system of having a few scattered fire patrols and to employ instead gangs of men in the larger interior forests and village watchers at the most important villages near the forests so that timely help can be obtained;
- (l) to lease the pasture in each block to a responsible person with the stipulation that, on the occurrence of fires, the block will forthwith be closed, but that, in the event of the forest being successfully protected, the lease will be continued for a further term to the lessee.

The preventive measures (*j*) and (*k*) have been suggested by Mr. Hodgson, the District Forest Officer, Cuddapah : they meet with the Board's approval, and the Collector of the district has accordingly been authorised to give effect to them as an experimental measure. It may as well be realised at once that the Department cannot at present, and probably never will be able to, protect all the grassy scrub jungles from fire ; their early burning under control, when the fire will do the least harm, seems, therefore, to the Board a sound principle ; early grazing will then be provided and one of the greatest temptations to the graziers towards incendiarism will thus be removed, the protection of the

more valuable forests being thereby rendered easier. The prohibition against penning cattle in the forests during the hot weather item (i)—a proposal which has also emanated from Mr. Hodgson, will, no doubt, also lessen the danger of fire occurring. The rules and conditions regulating the issue of grazing permits approved in Government Order, No. 45, Revenue, dated 26th January 1897, prohibit the penning of cattle in reserved forests except with the special permission of the District Forest Officer. The absolute prohibition of penning under these orders might, in certain areas where the grazing grounds are distant from the boundaries of the reserves or from places outside the reserve suitable for penning, amount to forbidding grazing altogether, and the condition should not be enforced to bring about this effect. District Forest Officers should, in all such cases, obtain the sanction of the Collector before forbidding penning.

The proposal (*h*) regarding the management of grazing grounds is made by Messrs. P. M. Lushington and A. B. Jackson: the Board, however, entirely dissents from the view taken by these officers. Mr. Brasier's suggestion (*i*) to lease the pasture in each block to a responsible person may be found suitable in some localities, but it could only be introduced where the person to whom it was proposed to grant the lease possessed influence with the villagers and could be trusted to deal fairly with them; the existence of faction would make its adoption impossible.

6. Of the preventive measures suggested above, those based on such expedients as fire lines, the isolation of blocks and the employment of fire patrols are at present being carried out by Forests Officers as far as the means and the establishment at their disposal permit. It may, the Board considers, be anticipated that each year these measures will become more effective, and that in course of time the Forest Department may thus look forward to the damage from fires once started being confined to smaller areas.

7. It is, however, most important to try and devise measures which will really prevent fires being lighted. At present it is the immediate selfish interest of a large number of people who frequent the reserves to set fire to them. Graziers, shikaris

minor produce contractors, all rejoice to see the jungle burn. The detection of incendiarism is most difficult, and even with an enormously increased staff, the prosecution and punishment of offenders will never be an important factor in putting a stop to this class of crime. It is necessary to make those who frequent and dwell in the reserves realise that it will not be even for their immediate advantage to fire the forests. This can only be done by a system of rewards or punishments in which the whole community will partake.

It may be objected that punitive measures which fall upon the whole community involving the innocent with the guilty are unjust, but it is impossible to devise effective measures which will not be open to this criticism. Such measures at all events ensure that the persons likely to be affected will do their best to prevent the recurrence of the events which have inconvenienced them.

8. The most important punitive measures recommended to be adopted in cases of incendiarism are given below—

- (1) Cancellation of all permits issued, whether for grazing or for other forest produce, in areas under special fire protection and charging full seigniorage rates for renewals.
- (2) Immediate and absolute closure to grazing of the burnt areas and the adjoining forests if necessary.
- (3) Raising the grazing fees in forests which have been burnt.
- (4) Total exclusion of cattle from the forests in the year in which the block was burnt and the imposition of enhanced fees in the succeeding year.
- (5) Issue of grazing permits with the proviso that they should automatically expire as soon as a fire occurred in the compartment and the imposition of a fresh grazing fee every time fire occurs without questioning its origin or inquiring if any attempt was made by the graziers to put it out, the fees paid for the fresh permits being refunded if, on subsequent inquiry, it is proved that the fire originated outside the compartment and that the graziers did their utmost to extinguish the same.
- (6) Making every minor produce contract liable to cancellation in the event of the leased blocks being burnt.
- (7) Raising the price of fuel in depôts and the price of permits for grass and fuel in villages adjoining forests where fire occurred.
- (8) Withdrawing from the wargdars in South Canara their kumaki rights on the occurrence of fires.
- (9) In cases where villages exist within reserves, making the villagers pay a punitive fee equal to not less than the actual annual cost of clearing the fire lines round the villages if in spite of these lines fires cross the forests.

The Board does not approve of the suggestion (5) made by Mr. Jackson or (8) and (9) made by the District Forest Officers of South Canara and Madura. Nor does the suggestion of Mr. Lodge contained in item (7), *viz.*, raising the price of fuel in depôts and the price of permits for grass and fuel, commend itself in its entirety to the Board. Every effort of the Department should, in the Board's opinion, be directed to make depôts popular so as to prevent as far as possible people going to the forests for unlawful purposes. Where, however, the fire could with reasonable certainty be traced to permit-holders, the punitive measures proposed would be certainly justifiable. As regards the other suggestions, it will be observed that there is a considerable conflict of opinion as to whether enhancement of fees or closure of the reserve to grazing is the most effective and suitable measure. The Board considers that it may be left to the local authorities to decide in each case whether suspected incendiarism in a reserve is to be punished by closure of the area or by the imposition of enhanced fees. The present Forest Member would, subject to the reservation mentioned below, generally prefer the punishment of closure to that of enhancement of grazing fees, as the former cuts more at the root of the evil by entirely preventing the offenders from gaining any advantage from their wrong-doing. Moreover, as pointed out by the District Forest Officer and the Collector of Tinnevelly, this method of punishment is less likely to conduce to corruption on the part of the subordinates by permitting the grazing of unlicensed cattle, since it is comparatively easy to detect illicit grazing when an area is entirely closed. At the same time the Board is of opinion that the punishment of closure should not in any case be worked so as to deprive cattle entirely of pasture, though it should, as observed by Mr. Brasier, always involve grave inconvenience to the graziers and owners, such as having to drive their cattle to remoter blocks and to take out perhaps fresh permits. Messrs. P. M. Lushington, Brasier, Bedford, and Buckley consider that the closure of a block without opening another area for the cattle to resort to would not result in the starvation of the cattle, and Mr. P. M. Lushington adds

that all valuable cattle could and would be kept alive by stall-feeding in a much better condition. The Board is, however, not prepared to recommend the adoption of any policy which would result in the practical starvation of the poorer cattle.

In cases where the punishment imposed takes the form of levy of enhanced fees, the Board considers that it is clearly necessary that the enhancement should be sufficiently substantial to make the offending villagers sensibly feel the penalty. As remarked by some of the officers consulted, the suggestion made by the District Forest Officer, Cuddapah, and approved in Board's Proceedings, Forest No. 67, dated 9th March 1903, to enhance the fee to the sanctioned maximum is not likely to be effective. The Board accordingly considers that the fee might be raised to double the sanctioned maximum as recommended by the Collectors of Kistna, Cuddapah, and Nellore, and by the Conservator of Forests, Northern Circle (Mr. Lodge) : such an enhancement could not be regarded as prohibitive in view of the existing exceedingly low rates.

9. All the officers consulted lay emphasis on the fact that whatever punishment is imposed it should be promptly inflicted. The Board agrees with them, and requests accordingly that Government will be pleased to authorise Collectors to exercise the powers of closing the reserves or of enhancing the fees delegated to the Board in Government Orders, No. 141, Revenue, dated 6th February 1902, and No. 1092, Revenue, dated 2nd November 1903. It should, however, be at the same time provided that any such orders passed by Collectors should be reported at once to the Board for confirmation, and that Collectors should furnish with their reports information on the points noted in the margin

- (1) Evidence that fire was due to incendiarism or culpable negligence.
- (2) Action taken by villagers, graziers, etc., in putting out the fire.
- (3) Reserves available in case area burnt is closed.
- (4) State of the season and pasture available on unreserved and private lands.

and on such other points as may be necessary to enable the Board to form an opinion on the suitability of the punishment awarded. With this information before the Board it can always correct any unduly harsh orders of the Collector in good time.

The Board also considers it most important that the orders passed

by the Collect or whether in regard to closing the reserves or enhancing the grazing fees should, if possible, be preceded by an inquiry on the spot by a responsible officer, such as the District Forest Officer or his Assistant or the Divisional Officer, at which the persons likely to be affected should be present. These persons would in this way know exactly what they were punished for, and would not imagine, as they otherwise might, that the closure or the enhanced fee was merely a piece of extortion on the part of the Forest subordinates.

10. Mr. Brasier draws attention to the orders of the Bombay Government, No. 7186, dated 13th October 1903, which direct that villages in which fires have been frequent or extensive should be selected and the villagers should be assembled and formally warned by the mamlatdar or Range Forest Officer or, when possible, by the Divisional Forest Officer in person that a recurrence of similarly extensive fires will result in the deprivation of all privileges including grazing. A similar system of giving notice to villagers of the consequences that may ensue on the occurrence of a fire is in force in this Presidency also. The warning is conveyed in this Presidency by the publication of a notification in the forest sheet of the District 'Gazette'; and Collectors have further been instructed in Board's Proceedings, Forest No. 264, dated 29th July 1901, to take care that the terms of the notices are made known at frequent intervals to the residents of villages adjoining reserved forests. The Board, however, doubts whether these orders are given effect to in practice, and in reminding Collectors of them it considers that the jamabandi time affords a good opportunity for carrying them out. It is observed that the Bombay Government Order above referred to also gives powers to Collectors to suspend for the year following the fire all the privileges which the villagers concerned enjoy or such of them as the Collector may consider it advisable to suspend, the privileges being restored at the end of the year unless, on the report of the Divisional Forest Officer, the Collector sees fit to continue the punishment for another year; in this latter case the sanction of the Commissioner has to be obtained for the continuance of the punishment. The Board considers that the Collectors in this

Presidency should similarly obtain the sanction of the Board if the penalties imposed by them are to be continued beyond one year.

II. The Board would prefer not to rely exclusively on punishments for incendiarism and departmental precautions for restricting and extinguishing fires, for the protection of the reserves against fire, and considers that in certain cases rewards might be granted when the forests had been free from fire. The following suggestions have been made :—

(a) to grant rewards to each village headman or talayari in whose jurisdiction no fire occurred for five years;

(b) to levy a higher rate of grazing fees in fire-protected blocks so as to contribute towards the cost of protection, and if the block or blocks escaped fire during one season to reduce the rates for the next season, and so on; and

(c) to employ jungle tribes as fire patrols, paying them by results at the end, of the fire season.

As regards the proposal in item (a), *viz.*, to grant rewards for protecting the forests from fire, which is made by the Collectors of Ganjam, Vizagapatam, and Kurnool, and the Conservator of Forests, Northern Circle (Mr. Lodge), the Board agrees with the last-named officer in considering that the principle laid down in Government Order No. 31, Revenue, dated 15th January 1894, should be maintained, and that villagers, unless employed as regular fire patrols, should not receive any payment for extinguishing fires. The objection to rewards for extinguishing fires does not apply to rewards being given in cases where fires have been successfully kept out of forests for some years. In such cases they might take the form of lower grazing fees and lower rates of permits for fuel. Such rewards would only be appropriate in the case of forests which by their situation the villagers can practically control, and can properly be allowed the credit for their immunity from fire, such as for instance forests surrounded by or close to villages. In large mountain forests the co-operation of the jungle tribes is essential. A system of rewards paid to such tribes is reported to have succeeded well in Coorg. Where such tribes are employed in gathering minor produce for the department the Board considers that they may be given a reward in the shape of better prices for produce when there are no fires and punished by poorer prices when there are fires.

The results of the system introduced in the Upper Godavari of employing jungle tribes as fire patrols and of paying them by results at the end of the fire season (item *c*) have, the Board notes, been very satisfactory. It might be adopted in forests similarly circumstanced, *viz.*, where the population is comparatively homogeneous and the headmen have considerable influence.

12. In the last but one of the papers read above, the Conservator of Forests, Northern Circle, submits for the Board's orders the proposals made by Mr. Cox for fire protection in the Nallamalais. These proposals seem to the Board to be well thought out. The fires on the Nallamalais are ascribed mainly to the Chenchus; and the importance of securing their co-operation cannot therefore be overestimated. The Board notes that the local District Forest Officers are thoroughly alive to the situation and are doing what they can in the matter. The Board has called on Mr. Brasier to give the subject of fire protection his special attention during his visit to the Nallamalais, and expects to receive from him shortly a full report on the subject.

13. In conclusion the Board cannot too strongly emphasise the enormous importance of fire protection of reserved forests. The destruction that is reported to be going on in North Coimbatore and depicted by Mr. A. W. Lushington is taking place more or less in all the forest reserves of the Presidency. The statistics of forest fires recorded in the annual reports are, the Board fears, very misleading; it is an undeniable fact that nearly everywhere forests are being systematically burnt. The entire destruction of young growth particularly is appalling and the trees that survive are largely ruined. In many of the reserves valuable timber trees are rendered almost useless owing to heart-shakes, warping and other forms of deterioration brought about by fires; and the Forest Member found that in the Nallamalais many of the finest timber trees could in consequence only be disposed of as fuel for railways. It is thus clear that, if forest conservancy is to be of any real service, every effort of the department must be concentrated on making fire protection effective. At present it is to be feared that in many districts owing mainly to the annual destruction of

tree growth by fires the reserved forests so far from improving are not even maintaining their ground.

Fires are easily started in the Indian jungles in the hot weather, and the agencies by which they may be started are, as has been already explained, very numerous. The Board therefore considers it impossible ever to expect that fires will be totally kept out of forests; but by adopting those of the measures discussed above which local officers consider most suitable to the conditions of their districts, the Board hopes that great improvement can be effected and that a large proportion of the more valuable forests can be effectively protected. When working-plans for forest reserves are elaborated and completed, the Board hopes to have a clear policy of fire protection for each area dealt with, and it is expected that by that time there will also be available a larger and more capable staff than at present to carry out the policy prescribed in those plans.

(TRUE EXTRACT.)

(Signed) N. MACMICHAEL,
Acting Secretary.

ORDER—No. 554, Revenue, dated 14th June 1905.

FOREST No. 105.

In the Proceedings read above, the Board of Revenue deals with the several measures suggested for the protection of forests from fire. Subject to the remarks in the following paragraphs the Government agree generally in the views propounded by the Board.

2. In the selection of measures to prevent fire, it must be clearly recognised that the practice of burning grass is no new one, and that it is in fact necessary in order to improve grazing. The Government accordingly consider that the best way to deal with the problem is to control the burning rather than to attempt to stop it, and, where grazing is required, to burn under departmental management and supervision a sufficient area to meet the proper requirements of the graziers. This measure is reported to have been already introduced in the Cuddapah district, and the Government consider that it should be given general application.

3. When, in spite of this and other precautions, the illicit burning of forest areas occurs and can be attributed on reasonable grounds to the action of graziers, such conduct can be most suitably and effectively dealt with by closing the burnt areas to grazing, and so depriving the delinquents of the benefit they sought. The Government agree with the Board and the officers consulted by it that in such cases whatever action is taken must be taken promptly, and they accordingly approve of the proposal to authorise Collectors to exercise the power of closing the reserves subject to report to and confirmation by the Board as proposed in paragraph 9 of the Proceedings. No such penalty imposed by a Collector should continue beyond the year in which it is imposed without the distinct sanction of the Board.

4. The Government consider that it is not desirable to delegate to the Collectors the power of enhancing grazing fees, and that such a power should be exercised only by the Board of Revenue. In the opinion of His Excellency the Governor in Council this power should not be used except in very exceptional circumstances, and while refraining from entirely prohibiting the enhancement of grazing fees as a penalty, the Government desire that resort to this expedient should only be had as a last resource. Should it become necessary thus to enhance grazing fees, special notices explaining the reason of the enhancement should be published in the villages concerned, and the limit of enhancement will be to double the previously sanctioned maximum.

5. To prevent the burning caused by the contractors of minor forest produce, the contract should be made liable to cancellation in the event of the leased blocks being burnt. A condition to this effect should accordingly be inserted in all such contracts.

6. The Government approve of the proposals to grant rewards to each village headman or talayari in whose jurisdiction no fire has occurred for five years, and to employ jungle tribes as fire patrols, paying them by results at the end of the fire season. It should be the policy of the Forest Department to enlist the services of jungle tribes for every purpose for which they can conveniently be utilised and to get them under its control by

making them its paid servants; and it follows that whenever possible they should be employed as fire patrols. The third suggestion in paragraph 11 of the Board's Proceedings to levy higher grazing fees in fire-protected blocks does not appear to the Government to be sound in principle, and cannot be approved.

(TRUE EXTRACT.)

(Signed) A. G. CARDEW,
Ag. Secretary to Government.

MISCELLANEA.

BRITISH WOODLANDS.

Sir Herbert Maxwell, Bart., M.P., recently read a most interesting paper on "British Woodlands," at the Society of Arts, Mr. Munro Ferguson presiding. Mentioning that his subject was rather a large one for the time available, Sir Herbert continued—I will divide it into two branches—first, what I conceive the State might do, with prudence and profit, to develop the national resources; second, what private owners might do to develop the resources of their estates.

Since I entered Parliament 25 years ago two inquiries have been directed into this subject; the first, a Select Committee of the House of Commons, which sat 1885-6-7; the second, as Departmental Committee, which reported in 1902. No action was taken on the report of the first: of the result of the second we have more hopes, because we have now, what we had not in 1885-7, a Government department—the Board of Agriculture and Fisheries—to which has been committed the duty of promoting instruction in forestry. Among the many points upon which both these Committees were in thorough agreement were these facts—
(1) That "the world is rapidly approaching a shortage, if not an actual dearth, in its supply of coniferous timber, which constitutes between 80 and 90 per cent of the total British timber imports;"
(2) That there is a vast area, estimated in millions of acres, capable of growing timber of the finest quality; (3) That the climate of the British Isles is favourable to economic forestry

conducted on a proper scale (not in grudging patches, clumps and strips); and (4) That it requires only the exercise of timely forethought and a moderate annual expenditure to anticipate the time when scarcity of foreign timber shall have greatly enhanced the price, and to replace with British-grown timber much of those enormous imports upon which we depend at present.

These four points having been emphatically affirmed by the two Committees, I need say nothing more upon them to-night; but there is a fifth point on which I venture to go a little further than the Departmental Committee. "We do not feel justified," says the report, "in urging the Government to embark forthwith upon any general scheme of State forestry under present circumstances." Well, I have the temerity, which the Committee lacked, to urge strongly the wisdom of embarking upon a scheme of State forestry, and if I am blamed for that temerity, my demand is only a small one. I only ask for the investment—the investment, mind, not the gift—of £10,000 a year for the purchase and planting of suitable land.

No branch of agriculture, not even wheat growing, has suffered such a slump in the last 25 years as hill sheep-farming. There are hundreds of thousands of acres in Scotland, once valuable sheep pasture, now rented at not more than two shillings an acre. From some of it, a good additional return, say a shilling an acre, is obtained for the grouse on it, but a great deal of it is unsuitable for grouse, but very suitable for growing timber. Such land is constantly being offered for sale. Twenty-five years' purchase would secure 1,000 such acres for £2,500. If the ground is level, planting 3ft. by 3ft. will take 4,840,000 trees; the cost at £6 an acre equals £6,000 for the 1,000 acres. On sloping or steep ground fewer trees will be required, and the cost will be proportionately less. I make no provision for houses or fences, assuming that the farm is bought all standing, but £500 must be allowed for repairs and preliminary draining, making a total initial outlay of £9,000 on the 1,000 acres. The interest on the balance of £1,000 ought to pay the annual tool bill, and the annual wage bill may be reckoned at—Head forester, £120; Foreman, £52;

Eight woodmen at 18s. per week, £374·8 ; Miscellaneous £103·12 ; Total, £650. Shall we be able to meet this charge, draw interest on the capital sunk, and hold our capital in hand at the end of 100 years ? I think so, even allowing that for the first fifteen years not a farthing of revenue can be drawn from the plantation. By that time the £10,000 sunk will have increased at 3 per cent compound interest to about £15,000. To secure 3 per cent upon that sum and to defray the annual expenses of £650, we must show a net annual profit of £1,100 from the 1,000 acres. The returns ought to commence fifteen years after planting, beginning with pitprops, for which there is an insatiable demand in this country, chiefly supplied from Norway and Sweden ; proceeding to medium-sized trees removed in thinning until the period of commercial maturity, which, in the case of Scotch pine and larch, should be reached in 80 or 90 years, when the regular falls will begin. Mr. Nisbet estimates the average annual yield of coniferous timber, Scotch and larch, at 75 cubic feet per acre. Assuming this to be a moderate estimate, and assuming that the price of such timber will not exceed 6d. a foot (an improbably low estimate), your 1,000 acres will be yielding a gross annual income of £1,875, that is, a revenue of 37s. 6d. an acre from land which, as sheep pasture, yielded a rent of 2s. an acre, or £100 from the 1,000 acres. Supposing that for the next 50 years the State were to invest £10,000 a year in plantations, it would have made a progressive investment of half a million sterling—the cost of four days ‘campaign against’ the Boers—yielding about 11 per cent interest, and instead of a rural population of one shepherd to 1,000 acres of pasture, there would be one woodman to every 100, or a total of 500 woodmen on the State forest of 50,000 acres, instead of 50 shepherds—no trifling consideration this in these days of rural depopulation.

There appeared lately in one of the evening papers a letter from a noble earl in reference to Mr. Keir Hardie's proposal for State forestry. His lordship declared that it was futile to think of profitable forestry in the United Kingdom for two reasons—first, because of the furious storms which sweep these islands at irregular intervals ; second, because the timber produced in our woods is far inferior in quality to that grown on the Continent.

As to the first objection, I deny emphatically that we are more exposed to storm than, say, Norway and Sweden, whence we draw such large supplies of coniferous timber. It is true that we suffer far more from wind damage than is the case in continental forests, but that is the result partly of our custom of planting in narrow belts and isolated small masses, and partly of the mischievous system of over-thinning which came into vogue in the nineteenth century. Trees that have been encouraged to grow heads out of all due proportion to their height will succumb to a storm that may be lifted harmlessly over a solid block of well-grown forest. A thousand *contiguous* acres of woodland will suffer far less from gales than 1,000 acres scattered over an estate of 10,000 acres.

Next, as to the alleged inferiority of British timber to continental. Surely that is a strange allegation against a country that used to supply timber for the noblest fleets that ever put to sea. I may say in passing that the demand for ship timber had something to do with initiating our vicious system of over-thinning. Shipwrights did not want straight boles—they wanted bent timber—and you will actually find in old treatises on forestry instructions about tying down the limbs of oaks to produce the desired contortion. The result has been that we have conceived and aimed at a false ideal. Our notion of what an oak ought to be is framed upon such a magnificent deformity as the "Major" oak in Sherwood Forest.

That we can grow fine straight oak if we choose may be seen from the New Forest, a domain which, unhappily, the State is not permitted to treat on right principles. Here again is a wood of self-sown oak at Thornbury, in Gloucestershire, 30 to 40 years old, which promises to develop into splendid clean timber. But to obtain examples of the highest development of oak timber, we must go to France.

Now that we want straight, clean timber, there is no country in the world better able to produce it than our own. "Ah," says the timber merchant, "but your firs are grown too fast. British deal cannot compare with Scandinavian, which is grown much slower." True, but here again the evil comes from over-thinning. Grow your trees in close forest, and no matter what height they attain or how

soon they attain it, the annual rings will be close together, and the timber will be slow grown. It is a mere question of forest management. Trees in open order will produce branches and coarse timber, with wide annual rings; trees grown in close canopy will yield clean planks with narrow annual rings. Here are some examples from a wood of Mr. Elwes's, at Colesborne, in Gloucestershire. Most of these trees measure 125 feet in height, and compare favourably in cleanliness of bole with the following examples from Savoy—silver fir with a few spruce, and silver fir with a larch or two.

It is idle to say that timber cannot be grown at a handsome profit in Great Britain, but it is equally idle to attempt to grow it at a profit unless sound principles of commercial forestry are adopted.

I stood not long ago beside the owner of one of the noblest parks in England. He had brought me to see an oak wood, originally pure forest, about 50 acres in extent, which was causing him much concern. They were splendid trees, about 180 to 200 years old, averaging 100 feet in height with 40, 50, 60 feet of glorious clean boles. I don't know the like of this wood, as it must have been, if it be not the forest of Cour Chevernay on the Loire opposite Blois. Twenty years ago there cannot have been less than 9,000 or 10,000 cubic feet per acre, which, taken at only 1*s.* a foot, represents a value on the 50 acres of some £25,000, or £500 an acre. Who could have blamed the owner had he treated this woodland as a crop? Well, all his neighbours would have blamed him bitterly, so deeply rooted has become our habit of looking upon woodland merely as an extra—a luxury—a playground. And yet I maintain that it was folly not to turn this timber to account. For look you what has happened. My friend had all the amateur love of trees which is so characteristic of English country gentlemen. About twenty years ago, thinking to improve the landscape, he had glades cut in this noble grove, and thinned out the whole of it severely. His forester, if he knew his business, may have warned him what must happen if pure oak high wood is suddenly converted into trees in open order. If he did so, his advice was disregarded; the owner knew what he wanted, but the result has been far different. Nearly every tree

has become stagheaded and thrown out an eruption of growth all along the stems and branches. The grove has been ruined.

My friend did me the honour to ask my opinion. If I had given it, he would have called me a beggarly Scot, so I held my peace, even from good words. But I had no doubt what a wise forester's advice would be—fell all the remaining trees and replant. As near as I could judge, there seemed to be an average of thirty oaks left on every acre. These cannot be worth less than £7 10s. apiece standing, or an aggregate of £11,300 on the 50 acres. I have purposely put this calculation very low, for I was shown where one of these oaks had been felled recently, and the timber sold for £20. But I know what will happen. My friend loves his trees ; he will never harden his heart to part with them ; they will go from bad to worse, and the greater part of this money will be sacrificed. The future of these noble trees will be like that of the mournful ruins of Cadzow Forest, Lanarkshire.

Sir Herbert wound up his paper by alluding to the manner in which estates made use of their own timber, pointing out that it would be much cheaper for owners to go to the open market since their own wood as at present grown was an exceedingly costly article. He also showed that the reason why owners could not sell even their own fine quality timber was because there was no regular supply nor uniformity of quality in English grown timber, and therefore dealers very naturally left the article entirely alone.

At the close of the paper the Chairman read a few remarks from Dr. Schlich, whom indisposition had prevented from attending, and in the discussion which followed both Sir Dietrich Brandis and Mr. W. R. Fisher took part.

ADVANTAGE OF CO-OPERATION BETWEEN THE
GOVERNMENT AND LIVESTOCKS ASSOCIATION
IN THE REGULATION AND CONTROL OF
GRAZING IN FOREST RESERVES.

BY FRED P. JOHNSON, SECRETARY, NATIONAL LIVESTOCKS ASSOCIATION,
UNITED STATES.

Assuming that it is conceded that the forest reserves may be used in an economical manner for the grazing of livestocks.

the absolute necessity of an efficient control and regulation of this privilege, for the protection of the reserves, must be admitted. To those not familiar with the vast areas the forest reserves cover the task of providing an efficient patrol to guard them and prevent their injury may seem a mere matter of detail. Those who are familiar with these conditions, on the contrary, are inclined to the belief that the whole United States Army would hardly furnish enough men to give the adequate protection needed. While, under the present system of patrol, a small army of men are in service, the protection afforded is only nominal. How then can the stockmen be allowed to graze in these reserves with the assurance that they will be rightly used, and not only the grazing but the forests as well be protected from misuse and vandalism, for there is vandalism in grazing as well as in the destruction of forests?

From my knowledge of the stockmen in the West, I can assert that there is no class of men more vitally interested in sane and reasonable forest protection than the stockman. If given an opportunity, no class of men could furnish more absolute and reliable protection for these reserves. But would they do it? Yes, if properly approached in the matter. The Western stockman is of a peculiar disposition, due probably to his environment. Restless and impatient under any attempt to bind him to iron-clad rules and regulations, yet, when approached with a request for help and assistance, even though he may derive no benefit, he is quick to respond.

It has been the failure of Governmental departments to understand this phase of his character that has resulted in much opposition to forest reserves. As the Pioneer, who braved the dangers and hardships of the frontier to open the way to civilisation, he has felt that he had acquired some moral rights which even the Government should respect, and to have a stranger ride up to him while on the range and dictate to him things that he may or may not do, even though spoken in the name of the Government, is galling to his pride and that feeling of absolute freedom which has been bred in his nature. Approached by the proper officials with an explanation of the necessity of the forest reserves, the good that will eventually result to him from their establishment, and a request

for assistance in maintaining them and carrying out the plans of the Government, would meet with immediate and hearty response.

All over the West there are organisations of stockmen who have associated themselves together for the protection of their interests and for the improvement of conditions in their industry. These organisations are composed of the leading and progressive stockmen in the various districts. These are men who are building homes in the desert, and they are profoundly interested in anything that affects the prosperity of their locality. Here already organised is an army of men greater than any the Government could press into service for this purpose, ready, willing, effective and to be had for the asking. The Government has only to request that, in return for the privileges of grazing on these reserves, the organised Stocks Association assume the tasks of protecting them, fostering the vegetation and preventing fire and vandalism. It is possible that many of them do not thoroughly understand the problem the Government has undertaken to solve; then they should be enlightened, and it would be found that there would be no more enthusiastic supporters of the reserves than the stockmen.

It must not be understood that I advocate the complete turning over of these reserves to the stock interests.

The Government control and supervision must be absolute, but the organised stockmen could be sworn in as Forest Officers. They should have at least an advisory voice in the making of the rules and regulations and in return should be given as much freedom in the use of the reserves for grazing purposes as would be consistent and in keeping with the objects to be attained.

The advantage of such co-operation between the Government and stockmen must be evident. The advantage to the Government is to enlist the active assistance of men who live on the ground, as it were, in the advancement of the forest reserve idea. Under such an arrangement the reserves would have a better protection than could possibly be obtained in any other way and at the minimum cost for administration.

Instead of the antagonism of a large class of citizens, who really have rights that the public is morally bound to respect, you

will have their enthusiastic support. This, in my mind, is worth much. On the other hand, the stockmen are made to realise that these reserves are being maintained for the benefit of the community in which they live, and they, having secured a personal interest in the success of the idea, will do their utmost to build up the reserves along the lines desired. While they are given the right to use the reserves for grazing purposes, the privilege will not be abused under such conditions, for the community being interested, will permit no abuse.

The time to inaugurate the proposed plan is at hand, since the reserves have passed into the control of the Department of Agriculture through the recent passage of a Bill by Congress transferring the administration of the reserves from the Department of the Interior. The Department of Agriculture is closer to the stockman than any other department of the Government, and now that the transfer is accomplished it will be an easy matter to secure this co-operation.

It is unnecessary in a paper of this kind to go into the details of a plan to secure this co-operation. It is a perfectly simple matter, and where there at present do not exist Livestocks Associations to take up this work, they would be quickly organised when it was understood that the Government was willing to recognise them and accept their assistance in the building up of the reserves and in the maintenance of their safety and integrity. As to the question of the wisdom of adopting the policy suggested, it seems to me that there can be no negative argument worth considering, none at least from those who understand the actual conditions in the West.

THE CULTIVATION OF JUTE IN MADRAS.—A proposal was mooted at the Agricultural Conference held at Pusa last cold weather to make experiments in growing jute in Madras. This suggestion was submitted to the Revenue Board, and it was agreed that a beginning should be made at the Samalkot farm. Jute is sown in Bengal in April, but it was pointed out by Mr. Barber that owing to the different climatic conditions it would not be necessary to sow until June at Samalkot. These sowings have been made,

and the result will be awaited with great interest. If successful it is proposed to start a separate jute farm either in the Godaveri or Kistna delta.

THE TIMBERS OF SAKHALIN.—The Moscow correspondent of the *Standard* says that Sakhalin, which has been captured by the Japanese, is heavily timbered throughout; no fewer than 28 varieties of woods employed in commerce are enumerated. It will be interesting to learn where the forests are situated and how much of the area under tree growth has been given back to the Russians.

REPORT OF THE CINCHONA PLANTATIONS IN THE NILGIRIS, MADRAS.—The Director's report on the Cinchona Plantations is an interesting and full one, and shows that the results attained during the year were most satisfactory. Extra work was thrown upon him and his staff owing to an alteration made in the system of selling quinine at post offices, the pice packets now consisting of seven grains instead of five. The restocking of the old plantations has been vigorously carried on, nearly three-quarters of a million of young plants raised from selected seed having been added to the nurseries. The intensive cultivation now carried on combined with the selection of the seed from high class trees only will, it is hoped, greatly increase the future productive powers of the plantations. The quantity of bark harvested was greatly in excess of that of the previous year. The outturn of quinine from 504,000 lbs. of bark worked up in the factory was 12,920 lbs. Bark purchased from private growers yielded 2·5 per cent of quinine against 3·3 in 1903-04, and estate bark yielded 2·5 per cent against 3·01; the latter consisted mainly of prunings and the bark of sickly trees, whilst the purchased bark is stated to have been of much poorer quality than usual. As a result the total cost per pound of manufactured quinine rose from Rs. 10-7-8 to Rs. 11-3-10·52. The quantities both of quinine and febrifuge sold to hospitals, Native States, etc., again increased, and there was a corresponding increase under the receipts.

MOSQUITOES IN SOUTHERN LANCASHIRE.—Mosquitoes are making their unwelcome appearance in various villages bordering

the Manchester Ship Canal between Accrington and Manchester. The pests are supposed to have been brought up the waterway in timber boats from foreign countries.

CATTLE MORTALITY IN MADRAS.—A properly equipped and strong veterinary establishment would seem to be required in the Madras Presidency in order to be able to successfully cope with the heavy mortality amongst cattle. For the quarter ending December 31st, 1904, we find there were 25,674 deaths. Of this no less than 9,701 deaths are attributed to unspecified diseases—a fact which speaks for itself. Four thousand three hundred and twenty-three deaths occurred from snake-bite and from the rapacity of wild animals. From the latter cause the number was the highest on record during the last five quarters, totalling 3,661. It is suggested that it may be worth while considering how this heavy loss can be averted or at least modified. The districts of Nellore, Ganjam, Kistna, Godaveri, and Kurnool were the worst, each reporting 2,000 deaths or a total of 12,117, which was nearly a half of the total loss in the Presidency. Cuddapah was close up with 1,709 deaths. If these six districts alone were taken in hand and a strong veterinary staff appointed, an immense benefit would accrue to the people, whilst, doubtless, veterinary science would learn much that is at present hidden in impenetrable darkness.

THE EXPEDITION TO THE INDIAN OCEAN.—Mr. Stanley Gardiner, the leader of the expedition for the exploration of the Indian Ocean between Ceylon and the Seychelles in H.M.S. "Skylark," wrote in a letter received recently at Home that the expedition leaving Colombo on May 8th was expected to arrive at Chagos Archipelago about May 20th, where it would work until July 15th, thence going to Mauritius and remaining there till August 15th. From Mauritius the "Skylark" will return to the Seychelles, remaining there between September 8th and 15th. From the Seychelles the various Amirante Islands will be visited, the return to the Seychelles being made about October 15th.

The Central Forest Nursery, Godhra, Panch Mahals, Bombay Presidency.

INDIAN FORESTER

NOVEMBER, 1905.

INDIAN FOREST LITERATURE AND ITS PUBLICATION.

We had occasion to allude to a caustic but, we fear, unrefutable comment made by an American Forest Officer on the subject of the literature on forest subjects, or rather the absence of it, published by the Indian Service. The officer in question had been touring in India and, we gather from his remarks, had expected to find forest literature as abundant and as easily procurable as in his own country. What did he discover? The publications issued were practically confined to Annual Reports and Working Plans, and of these it was almost impossible to procure copies! This may not be pleasant reading for the Service, but the unvarnished statement of facts may lead to a better realisation of the position in this respect on the part of the Department. We are far from being prepared to agree with remarks not infrequently made that Government do not do anything. Can any member of the Service say that they have ever written an original paper, pamphlet or book on any subject of forest utility or interest and have asked Government in vain to publish it. We have not heard of such a case. Has the Appendix Series of the *Indian Forester* been made as much use of as it might? It is a purely Government affair. All papers published in it must be at first accepted by the Inspector-General and are then published and paid for by him. Another excuse offered is the want of time. We grant that this has often a good solid foundation of fact to rest upon when we remember the heavy administrative duties and the climatic conditions of the country we serve in. But with all due allowances for such, can it be thought that some of the great French and German Forest Officers, to consider the older School first, and some of the American ones of the new School, have not their hands

equally full of administrative work and yet find time to put down their discoveries and observations on paper and, in addition to so setting them down, to take the extra trouble necessary to see that they are published, and so made available for use and reference, not only by their own Service alone but by the sister ones in other countries. The Indian Service prides itself on being the first Forest Service in the tropics or, we might say, out of Europe. This being so it can scarcely be held to be a satisfactory position of affairs that after several decades we should have practically no forest literature to help the many Forest Departments now in the process of construction all over the world and, what is of still greater importance, to help ourselves.

We believe, and we have good foundation for the belief, that the Department is awakening to a sense of its backwardness in this respect; and we would wish here to shortly consider a few suggestions as to the best, or we will say a good, method of tapping and getting published that vast store of valuable forest lore at present locked up in the brains of the Service. Many men have neither the time nor the inclination to sit down and collate their facts and notes into book or even pamphlet form, although they would be willing enough to set them down in rough notes which could be utilised for publication, with due acknowledgment, by others. If we require proof that this is the case we need look no further than the Dictionary of Economic Products, the Ledger Series, etc., of the Reporter of Economic Products, which contain so much information given by Forest Officers, and yet which is not available to them in the exact form they require it. The question then arises, in what form or shape could such notes be made available for general use? Imitation is said to be the sincerest form of flattery, and is perhaps for this reason not always in good repute. The level-headed man, however, would not hesitate to copy a thing he knew to be good, and we, in this question of publication, may turn with advantage and examine how the Geological Survey publish their results.

In 1868 the Survey commenced the publication of their *Records of the Geological Survey of India*, and these were issued in

yearly volumes, of four parts each, up to the year 1897. In addition to the *Records* a series known as the *Memoirs*, to which we shall allude later, were also issued. In the year 1898 as an experimental measure the *Records* were amalgamated with the *Memoirs* by the late Director. The present Director, Mr. T. H. Holland, F. R. S., found this amalgamation to be a mistake. In his own words, "It has been found, however, that, during the course of systematic survey operations, observations are made of considerable public interest (sometimes in their bearing on current scientific problems and sometimes of economic value) which it would be inadvisable to retain unpublished for the long periods sometimes necessary to complete the work of which such isolated observations form a part. That such observations, with the provisional inferences they permit, are of direct interest and value to the public is shown by the stimulus they give to private workers whose additional researches and criticisms are often of great value in the preparation of the more complete papers issued afterwards as memoirs dealing with well-defined areas or geological subjects." The amalgamation continued from 1898 to 1903, and during this period it was found that several reports were made which, whilst being unsuitable for the *Memoirs*, could only be referred to with undesirable brevity in the Annual Reports—in other words these reports were in danger of being lost altogether. Last year the Director restarted the *Records* as a series distinct from the *Memoirs*. The former now appear as parts, each part being issued as soon as enough material is ready to make it up. This ensures valuable notes and discoveries being at once issued, and so made available to the Survey and the public. Notes of economic and scientific value, short accounts of new discoveries, analyses and determinations made in the laboratory, etc., appear in these *Records*. They are open to private workers in India in addition to the Departmental Officers. The *Memoirs* are confined to completed papers on any particular matter which has formed the subject of enquiry, observation and research, perhaps over a considerable period of time, and in which definite results have been obtained.

We are of opinion that this procedure of issuing Departmental *Records* and *Memoirs* is one which is particularly applicable to the Forest Department in India. Many valuable notes on observations made and experiments undertaken are lost owing to their observers either keeping them to themselves, both successes and failures, or recording them in Annual Reports, a procedure which even the most sanguine among us must in the end come to the conclusion is practically *not* putting them upon record. Even if such reports were available, which is not the case, for officers in a province only see their provincial reports, no man would have the time to wade through scores of Annual Reports on the chance of finding in them something pertinent to an enquiry he was engaged upon. The case would be very different were indexed *Records* available for reference. As for the Working Plans, which we all know contain a vast amount of valuable information, a correspondent some time ago was good enough to suggest that the Honorary Editor might, in some clever way he suggested, index and make available certain information they contain. We are not decrying the suggestion, which was a valuable one, but unfortunately the Honorary Editor is a busy man, and has his own work to do in addition to bringing out the monthly numbers of the Journal in what spare time he can make available.

In the *Memoirs* we would publish complete papers such as, e.g., any complete sylvicultural note on the Sal tree for a particular province. Method of extraction, commercial uses, market prices, etc., of a tannin, dye, etc., etc. The *Memoirs* would be issued as completed papers become available for publication.

Finally we would suggest that the issue of both *Records* and *Memoirs* should be on such a scale as to make copies available, not only to the Department at large, but also to sister Services and others who could profit by their perusal throughout the world.

SCIENTIFIC PAPERS.

SOME INDIAN FOREST FUNGI

BY E. J. BUTLER, M. B., F. L. S.

CRYPTOGAMIC BOTANIST TO THE GOVERNMENT OF INDIA.

PART III.

PERIDERMIUM THOMSONI BERK. AND BARCLAYELLA
DEFORMANS DIET.

A fungus attack, of which two forms were found on the Himalayan spruce, *Picea Morinda* (*Abies Smithiana*), was described by Barclay in the *Journal of the Asiatic Society of Bengal* in 1886. The name *Æcidium* (*Peridermium*) *Thomsoni* was given to the fungus on the assumption of its identity with a species found in Sikkim by Hooker and described in the *Gardener's Chronicle* in 1852. The first of the forms described by Barclay had been previously referred to *Peridermium acicolum* by Cooke from specimens received from Dalhousie, in 1877. The same author received the second form from Mahasu, Simla, about the same time and referred it to *P. Thomsoni* (*Indian Forester*, Vol. III, p. 88). Both forms were, however, as above mentioned, taken by Barclay as stages of the one fungus, *Peridermium Thomsoni*, the first as the æcidial and the second as the uredo stage. Later on Professor Dietel, to whom specimens were sent, found that the latter was really a teleuto form, and referred it to a new genus *Barciayella*, of which it is the type and only known species. This view was accepted by Barclay, and the genetic connection of the two forms was left doubtful awaiting experimental investigation which has not been attempted so far.

It is common in the Himalaya from Mussoorie to Simla, and probably as far west as the Kurram valley of the Afghanistan frontier. I have received specimens at different times from Messrs. Oliver and MacIntosh, of the Imperial Forest Service, from Jaunsar.

The æcidial stage (*Peridermium Thomsoni*) as described by Barclay is conspicuous on account of its colour and of the drooping habit assumed by the affected shoots. Every needle of certain shoots is attacked, and instead of standing out stiffly from the stem they lie close together embracing it. Shoots of the current season's growth only appear to show it. Those attacked are usually considerably longer than the unaffected. Both stem and needles are yellow in colour and the older specimens are much thickened and curved.



FIG. 6.—*BARCLAYELLA DEFORMANS* ON THE SPRUCE.

Spermagonia appear towards the tip of the needles as little dark points uniformly distributed on the surface. The Æcidia are produced at a later period in two rows on the upper surface of the needles. At first they are pale red, but later on are reddish orange. They are long flat bodies formed by a colourless transparent membrane, containing æcidiospores.

The Barclayella is much commoner than the Peridermium, and is the only form which I have seen. A greater amount of deformity is produced on the affected shoots which, as before, appear to be always of the current year's growth. They are stunted, thickened and densely covered with curved needles, having at a distance an orange-red colour. Instead of forming two rows of isolated prominent spore-cases the teleutospores occupy two continuous flattened beds on the upper surface and two rows of smaller ones below. When young the whole emits a disagreeable odour.

One of the specimens sent me by Mr. MacIntosh in 1904 showed this form on the cones, in which position it has not previously been mentioned. The scales were attacked and some of them were deformed and stood out from the cone. Others



FIG. 7.—PERIDERMIUM PICEAE ON THE SPRUCE—*a* NATURAL SIZE; *b* MAGNIFIED THREE TIMES.

such as that shown in the figure were unaltered in shape. The teleuto beds occurred on the dorsal (outer) surface of the scale in one or more raised reddish bands.

PERIDERMUM PICEÆ BARCLAY.

The Himalayan spruce bears yet another rust, which I have received from Mr. Oliver from Jaunsar. This is the Peridermium piceæ described by Barclay.

The aecidial (Peridermium) stage alone is known. It appears as long narrow spore-cases arranged along the upper surface of the affected needles somewhat irregularly and not in two rows as in Peridermium Thomsoni. The needles are turned yellow, and, as before, terminal shoots of the current year's growth are attacked. There is little deformity produced, but the presence of the parasite is revealed even at a distance by the orange-yellow patches scattered throughout the tree.

Mr. Oliver informed me that he had seen trees in Chakrata Cantonment in 1902 dying or dead from the effects of this fungus. This was due to the loss of all infected needles in 1901, when the attack was very severe. The trees were so weakened in consequence that they were unable to make new shoots or only put out feeble ones. None of the conifer rusts in the Himalaya have been hitherto described causing such damage as this.

PERIDERMUM COMPLANATUM BARCLAY

I have received this species on *Pinus longifolia* from Simla, where it was described by Barclay, from Mr. Wroughton, I. F. S., and also from Palampur in the Kangra Valley collected by Mr. I. H. Burkill.

It resembles that last described except that the spore-cases are larger and are usually on the lateral or under surfaces of the needles. The attacked parts of the latter lose their colour, but the general effect of the fungus on the health of the tree appears to be slight. In Simla Barclay noticed that two crops are usually borne, one in November and the other, much more abundant, from February on to May. The former usually has spermagonia scattered irregularly over the surface of the needles while the latter has none.

A form (var. *corticola*) also occurs on the bark, where it does more harm than on the needles.

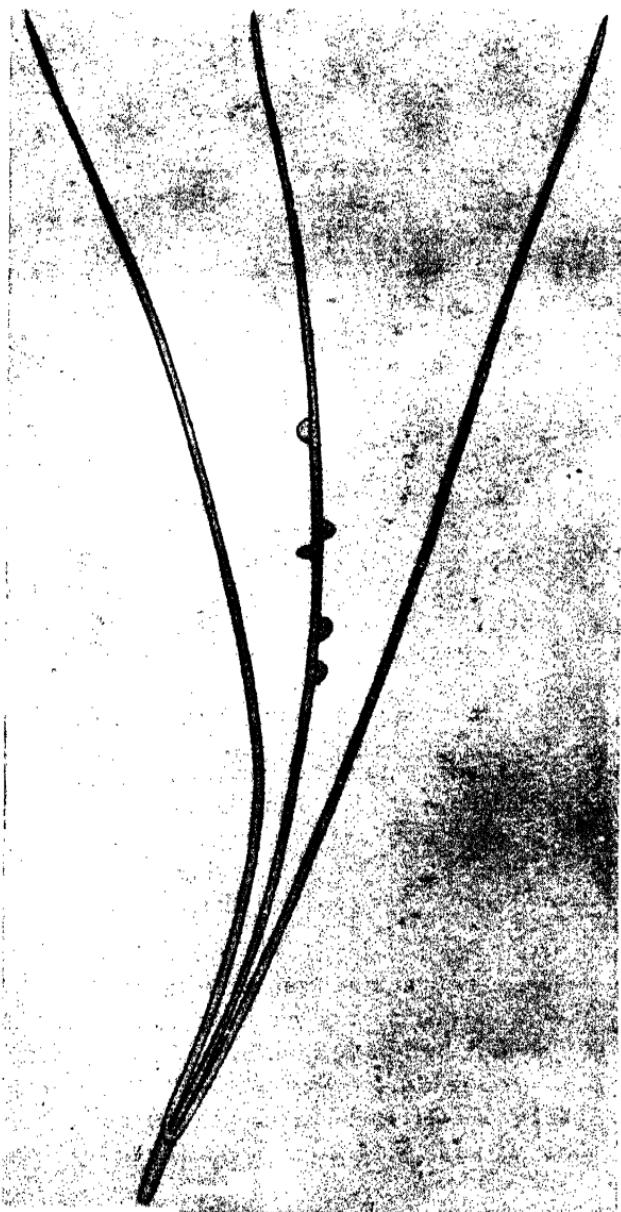


FIG. 8.—*PERIDERMIUM COMPLANATUM* ON *PINUS LONGIFOLIA*.

PERIDERMIUM BREVIUS BARCLAY.

This rust occurs commonly on *Pinus excelsa* in the same region as the last. It begins to appear according to Barclay about April in Simla, only one crop being produced. On the whole it resembles *Peridermium complanatum*, but the spore-cases are distinctly smaller. I have received it from Jaunsar.

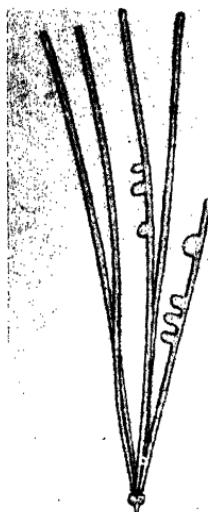


FIG. 6—*PERIDERMIUM BREVIUS* ON *PINUS EXCELSA*.

PERIDERMIUM CEDRI BARCLAY.

A rare *Æcidial* form was found in 1884 on deodar in the Sutlej Valley, where a severe attack was observed on a few trees. Some needles only of each rosette were affected and curved downward. Numerous small *Æcidia* burst out on the upper surface without any accompanying discolouration. I have not seen this species.

PERIDERMIUM EPHEDRÆ COOKE.

I have received this species on *Ephedra vulgaris* collected in Karamba, Jaunsar, by Mr. Hole, I. F. S., in May, 1904. It is the only known member of the genus outside the Coniferae.

The young shoots and leaves are attacked, the former bearing *Æcidia* and the latter numerous very prominent

spermagonia. Considerable thickening of the shoots occurs, and from the specimens received it appears as if the number of these is augmented and a sort of witch's broom deformity of the attacked branch induced.



FIG. 10.—*PERIDERMIUM EPHEDRAE* ON *EPHEDRA VULGARIS*.

The Æcidia appear all round the shoot as more or less cylindrical or bladder-like spore-cases containing orange-yellow spores. As in the case of the other Peridermia mentioned, no further stage is known. The species has previously been recorded on *Ephedra antisiphylitica* and *californica* from California and Texas.

(To be continued.)

ORIGINAL ARTICLES.

THE TEAK TIMBER TRADE OF BURMA.

BY T. A. HAUXWELL, CONSERVATOR OF FORESTS NORTHERN CIRCLE,
UPPER BURMA.

1. For the past two years or more the state of the Timber Trade in Burma has been viewed with alarm both by Government and by the mercantile community engaged therein, and grave apprehension has been openly expressed as to whether the diminished supply and high prices ruling would not only lead to the substitution of other woods, but that they might ultimately result in Burma totally losing the position it has held up to the present as the main supplier of teak for the whole world.

2. That this alarm is well founded is proved by the attempts lately made to substitute not only teak from Java but jharrah from Australia, both of which have come largely to the front, and although it is now found that the former is more brittle than Burma teak it is proved that both these woods can be used in lieu of teak for many purposes for which the latter was formerly solely in demand.

3. It is first necessary to see how this state of affairs has arisen, and the following table gives the details of the imports into the Europe market for the last 16 years :—

Imports of Teak into Europe from Burma and Siam.—Consumption, Stocks and Ruling Price.

Years.	From Burma (Squares), Tons.	CONVERSIONS,			Deliveries into Consumption. Tons.	Stocks 31st December. Tons.	RULING PRICE.		
		From Siam (Squares). Tons.	Total Squares and Convsns. Per cent.				Cargo Timber (floaters). Tons.	Planks. Tons.	
			46·36	45·542	55·152	17,114	£ 14 to 15	£ 14 to 15	
1904	18,047	6,381	21,114	45·67	55·287	26,774	14 "	14 to 16	
1903	29,206	5,697	29,341	64·24	55·287	17,767	12 "	15 "	
1902	17,193	9,059	29,231	52·68	67,511	29,795	12 "	14 " " 15	
1901	16,869	6,912	26,324	52·54	63·870	43,560	12 "	12 " " 14 $\frac{1}{2}$	
1900	38,291	8,323	31,664	40·45	78,278	69,349	13 "	12/10 to 14 $\frac{1}{2}$	
1899	32,841	8,995	26,254	38·56	68,090	78,632	13 "	13 $\frac{1}{2}$ to 14 $\frac{1}{2}$	
1898	41,857	12,402	22,829	29·62	77,688	83·241	12 to 13	13 $\frac{1}{2}$ to 14 $\frac{1}{2}$	
1897	38,884	19,821	25,553	78,829	70,139	51,326	12 to 12 $\frac{1}{2}$	10 to 13	
1896	33,358	13,973	19·58	66,759	78,344	42,636	11 " 12	12 to 12 $\frac{1}{2}$	
1895	39,260	20,328	11,284	15·93	70,819	55·511	54·221	9/10 to 11	
1894	35,051	7,998	8,773	16·93	51,822	50,181	38,913	10 to 11	
1893	28,067	28,067	1,942	19·70	38,488	48,745	37,272	9/10 to 11	
1892	32,167	5,483	6,689	15·99	44,344	43,544	47,534	10/5 to 12	
1891	34,632	14,460	6,913	12·35	56,005	56,954	46,728	10 to 12	
1890	44,994	24,079	4·837	6·54	73,910	69,946	47,677	10 to 10	
1889	54,450	11,434	4,345	6·19	70,229	59,224	43,713	... ...

4. From this we see (first) that imports into Europe have decreased from 54,500 tons to 18,000. Secondly, that prices have risen from £11 to £14 to 15 (and are still rising, having touched £19 in June 1905); and (thirdly) what is most important, that the imports of converted timber in the form of planks have steadily risen from 6 per cent to 46 per cent of the total exports, showing the decrease in first class squares; and (fourthly) that home stocks have diminished by more than 100 per cent.

5. It will be seen from the above that from 1889 to 1895 the home market was remarkably steady, and that it was from 1896 onwards that prices commenced to rise seriously, due to increased demand, and continued so to 1901-02, but the enhancement in price was up to this date to a certain extent controlled by increased supplies from previously accumulated stocks, but these becoming depleted and the output by lessees dropping suddenly from 151,000 tons to 77,000 tons in 1901-02 home prices then went up by leaps and bounds, till at the present moment they touch £19 per ton.

6. Added to this there is a downward tendency in the exports to India, which in 1898 were 144,000 tons and in 1904 only 106,000 tons. This is said to be due to competition from Siam and Java and also to large quantities of lessees' timber (undersized and refuse) being unfit for the Indian market even and which have to be disposed of in the round in Rangoon to prevent the accumulation of unwieldy stocks of inferior quality.

7. From the subjoined table of exports from Burma and Siam some further very interesting facts are apparent :—

Exports of Teak from Burma and Siam.

Years.	To Europe.		(PORTS OTHER THAN EUROPE.)		To India, &c.		From Burma.		From Siam.		Total.		GRAND TOTAL.	
	From Burma.	To Siam.	Total.		From Burma.	To India, &c.	Total.		From Burma.	To India, &c.	Total.		Tons.	Tons.
1904	34,602	16,691	51,293		106,404	61,617	168,021		141,096	78,308	219,404			
1905	60,955	9,551	70,506		116,219	51,202	167,421		177,174	60,753	237,927			
1906	36,387	10,111	46,498		112,079	47,543	159,422		148,466	57,454	205,920			
1907	43,586	13,157	56,743		128,308	37,251	165,559		171,894	50,448	222,302			
1908	59,212	11,182	70,394		138,371	27,150	165,521		197,583	38,332	235,915			
1899	58,424	11,066	69,493		140,589	28,442	169,031		199,013	39,511	238,524			
1898	59,318	8,859	68,177		144,752	17,636	162,388		204,070	26,495	237,565			
1897	72,520	17,820	90,320		134,236	26,351	160,587		206,736	44,171	250,907			
1896	45,711	18,835	64,546		135,665	28,025	164,290		181,376	47,460	228,836			
1895	52,954	24,775	77,729		146,688	36,995	183,683		199,642	61,770	261,412			
1894	48,176	13,777	61,253		138,579	24,105	162,614		186,685	37,182	223,867			
1893	35,615	5,650	41,265		121,933	17,684	139,617		157,548	23,334	186,882			
1892	50,225	2,050	52,926		125,95	10,880	136,175		175,571	13,530	189,101			
1891	41,465	5,500	46,965		126,198	9,163	135,261		167,563	14,663	182,226			
1890	36,657	19,010	56,457		135,852	13,470	149,322		172,509	33,070	205,579			
1889	67,783	24,410	92,193		113,857	13,862	127,719		181,640	38,272	219,912			

8. From this we see the steady advance of Siamese teak on the Indian market ; the exports to India being—

	Burma Teak.	Siam Teak.
	Tons.	Tons.
In 1894	...	138,000 24,000
In 1904	...	106,000 61,000

which is considerably detrimental to Burma.

9. Further, this statement seems to show that the present ruling high prices are mainly due to increase in demand as the total exports from Burma and Siam have hardly varied as a whole, being 219,912 tons in 1889 and 219,404 tons in 1904, a difference of only some 500 tons; but, whereas in 1889 Burma exported 181,000 tons against 38,000 tons from Siam, in 1904 the Burma exports were only 141,000 tons against Siam's 78,000; and while in 1889 of the total exports of 219,000 tons 92,000 tons went to Europe in 1904 only 51,000 tons could be supplied for that market, and it is noticeable that while from 1898 Siamese exports have gradually and permanently risen from 26,000 to 88,000 tons, Burma exports have decreased as gradually from 203,000 to 141,000 tons, and this placement is now threatened still more by the supply from Java.

10. What causes have led to this decrease of supplies and consequently to the high prices prevailing?

11. First and foremost the diminution in the supply of old girdled timber of large size. In former times this was available both in Upper and Lower Burma, and with unrestricted workings and the belief that the supply was unlimited was quickly made available. As the figures show, under controlled working the supply has been enormously curtailed, while the standard demanded has never been reduced. With the old original stock removed and the introduction of working plans by which the age of maturity of a teak tree is fixed on its reaching a girth of 7 feet the supply of Europe timber of first quality must be small. It is true that many working plans lay down that in certain localities, from which extraction is easy, trees may be allowed to remain to attain a larger girth; but so far this has not been laid

down as a prescription and I am afraid with the existing pressure of other work is more often than not overlooked.

12. In addition, although the reservation of teak-bearing areas has proceeded apace, girdling operations in these have been withheld as much as possible pending the preparation of working plans. As until these are compiled their capabilities are entirely unknown, and naturally the material in most cases derived from unreserved areas is of inferior quality.

13. Another factor in the case is the increased cost of working, due, among others, to the following causes :—

(I) Having to work in less accessible areas. It must be remembered that Burma is essentially a country of waterways, and the extraction of teak has always been mainly effected by this means. In former times the trees were felled and logged in the forests, chiefly in the neighbourhood of the main floating streams, a short drag was only necessary to get them there, and they were then allowed to float out with little assistance on successive rises, to the main river, often taking three or four years to do so, and then were rafted to the main centre. As time went on material was only found further afield necessitating often many miles of drag to a floating stream and in suitable localities cart transport, both ordinary and on special carts dragged by elephants necessitating the making of roads, was introduced while recently use has been made of a traction engine, but this is only possible in very few places.

(II) The increase in the cost of elephants without which work could not proceed. The price of these has increased over 100 per cent., tuskers averaging some Rs. 4,500 each while good dragging females cost Rs. 3,000 to Rs. 3,500. Seeing that some 1,600 to 1,700 elephants are employed at present by lessees the increased cost of working under this head alone is very considerable, which is further accentuated by the percentage of casualties brought on by overwork necessitated by short leases not allowing of the full advantage being taken of unaided extraction by water; in addition to which the animals have to be employed longer into the dry season than formerly to ensure the timber reaching the streams in time.

(III) Increased rate of royalty demanded. Since 1890 rates have risen from Rs. 10 per ton for full-sized and Rs. 6 per ton for under-sized to Rs. 25 and Rs. 8 respectively, while recently as much as Rs. 35 per ton has been paid for special girdlings estimated to yield a higher proportion of Europe squares.

(IV) More rigid prescriptions as regards working. In former days undoubtedly the best was taken and the inferior stuff left, but now under the contracts all marketable material is bound to be brought out and royalty paid on it, and we know that under-sized refuse logs alone amount to about 22 per cent of the total outturn, and as this is only suitable for the local market a very large proportion of the expenditure incurred must fall on the better class of timber, more especially that of Europe quality which is a very small percentage. This, however, is a great point in favour of working by lessees, as after they have done working in a forest nothing is left but small stuff only suitable for conversion on the spot into "cart wheel pieces" or charcoal, whereas in departmental working it is often necessary to arrange for the removal of a large amount of material, fit only for the local market, after the first class girdled timber has been removed.

14. As a set off against the above it has been urged that lessees have been able to make considerable retrenchments by reducing both their staff and the salaries paid them and also by the abolition of bonuses. The last it is true in many cases have been abolished, and I can only suggest that some *quid pro quo* has been substituted; but I am not of opinion that in comparison with the output staffs have been reduced or salaries either. So far as my experience goes the standard of the staff has been considerably improved due to the necessity of keeping greater control over the workings and to this staff being brought closer into contact with Government officials, and this I should imagine would require corresponding salaries being offered.

15. Royalty rates under purchase contracts have also been forced up here in the same way and for the same reason as prices at Government auctions. Firms in competition and non-working exporters in the hopes of getting a footing have, so to

speak, gambled in the business, while others to keep their position there have not only had to pay heavily but have had also to organise business of the same kind in those countries from which the supplies of other material are taking the place of Burma teak in the fear of business in this Province alone not being sufficiently remunerative.

16. Also the area open to exploitation has annually increased by the opening up of unknown and less accessible areas but as already mentioned, until working plans have been prepared these cannot be exploited to their full possibility, and further supplies of first class material are only slowly coming forward. It is true that new markets in different parts of the world are also opening up, *viz.*, South Africa, Japan, etc., and increased activity in naval construction is universal, but at the same time even there teak timber is not in such demand as formerly and the high standard of quality demanded has never for one moment been lowered. In this Province and in India the demand for teak for local use has undoubtedly increased, but in very many cases it has been sold at a merely marginal profit to prevent the accumulation of enormous stocks and also to prevent teak from elsewhere obtaining a footing, and here also the slight increase in price has led to the substitution of inferior woods.

17. Let us now examine the system of working in Burma. This may be divided under three heads—

(I) Extraction by Government agency, by which the material brought to market is put up to public auction.

(II) Extraction by lessees or really holders of purchase contracts who pay a fixed royalty according to size and quality on all timber extracted which then becomes their own private property.

(III) Extraction by licensees.

The material extracted under this last system is entirely utilised locally and for the purposes of this article need not be taken into account.

18. The subjoined table shows the total output of teak in Burma from all sources during the past 16 years :—

Statement showing the total output of Teak in Burma taken from Forest Administration Reports.

Years.	Extracted by Government and Contract Agency.	Copropriation as per Duty Statement.	Darwood.	MacGregor.	Seels.	Focer.	Wilkier and Kawli.	Mede Hardy. Metho Ho-	Mr. Muu Jaw & M. Bawuk.	Purchasers Ltd. Sawmills.	Total.	Free Grants.	Total output Burms tons.	Foreign Timber in Moulmein Logs.	Total output in tons.	
1881-88	39,873	39,359	...	...	1,079	...	2,706	37,124	40,909	569	120,710	118,958	118,958	118,958	118,958
1888-89	55,183	87,325	...	...	412	...	8,468	43,865	52,685	213	195,406	135,755	135,755	135,755	135,755
1889-90	62,992	132,494	...	...	266	3,410	6,392	54,234	64,522	66	280,074	123,622	123,622	123,622	123,622
1890-91	42,012	107,665	...	...	1,189	4,601	...	66,483	72,213	197	222,147	116,322	116,322	116,322	116,322
1891-92	50,763	67,702	1,256	...	973	458	...	51,089	52,520	3,573	175,814	84,278	84,278	84,278	84,278	
1892-93	54,596	120,474	7,931	21,806	...	664	4,930	67,041	72,655	10,983	288,445	118,592	118,592	118,592	118,592	
1893-94	52,002	150,794	18,583	...	1,796	4,761	...	17,281	23,838	5,937	* 256,988	134,811	134,811	134,811	134,811	
1894-95	45,078	132,474	10,453	...	...	4,543	...	32,848	37,391	5,881	244,616	125,881	125,881	125,881	125,881
1895-96	53,519	141,370	4,124	18,970	...	860	...	35,647	36,507	5,554	260,014	97,524	97,524	97,524	97,524	
1896-97	63,709	152,441	10,347	13,798	...	...	4,349	27,566	31,915	3,743	276,353	137,889	137,889	137,889	137,889
1897-98	64,136	220,486	8,588	25,998	...	...	1,391	23,532	25,973	4,541	349,722	122,070	122,070	122,070	122,070
1898-99	73,375	168,913	13,160	11,932	2,727	638	...	21,446	23,848	3,366	297,959	131,340	131,340	131,340	131,340	
1899-00	59,150	136,608	21,062	20,542	3,115	523	...	...	26,975	5,449	271,424	115,060	115,060	115,060	115,060
1900-01	51,856	117,666	10,760	15,463	6,382	903	...	36,676	36,676	5,019	244,785	154,341	154,341	154,341	154,341	
1901-02	60,133	39,761	14,714	14,236	7,670	575	28,788	28,788	3,900	169,699	92,914	92,914	92,914	92,914
1902-03	66,479	47,785	14,284	8,940	10,910	1,463	19,719	19,719	3,261	166,671	122,318	122,318	122,318	122,318
1903-04	100,959	62,913	11,964	21,091	7,209	836	28,376	28,376	2,615	235,953	103,351	103,351	103,351	103,351

* Excluding 15,808 tons lapsed drift.

19. From this we obtain the following information :—

	Government outturn.	Lessees.
	Tons.	Tons.
1888—1896	... 416,145	1,086,567
1897—1904	... 533,297	1,235,757
	<hr/>	<hr/>
	950,142	2,322,324

therefrom

Increase in Government supplies	... 117,852
Do. Lessees	" ... 149,190

but as regards the latter the increase during the second period is more apparent than real as is shown by the following figures :—

	Tons.
Average outturn by lessees during 1896 to 1901	194,323
Actuals during 1901-02	... 76,958
Do. 1902-03	... 83,182
Do. 1903-04	... 104,003

the heavy drop in 1901-02 being due to the lapsing of the Pyinmana purchase contracts which were continued by the British Government at a very low rate of royalty after the taking of Upper Burma.

20. As will be seen there has been very little fluctuation in the imports of teak into Moulmein from Siam averaging 119,000 tons annually, and consequently these figures also need not be taken into account.

21. The increase under the head of extraction by Government agency is due to the increased area brought under regular working plans, while the decrease in the output by lessees is primarily due, as mentioned above, to the leases of the Pyinmana forest having lapsed and also to supplies of girdled timber falling short pending the preparation of working plans and to working having to be carried on in less accessible areas.

22. Having now seen the quantity of material available let us consider the financial position.

On account of timber extracted by Government agency and put up to public auction the ruling rates have been as follows :—

Average cube of Government logs sold and rates realised at public auctions at Rangoon :—

During	C. ft. per log.	AVERAGE.		
		Rate per ton.	Rs. a. p.	Rate per log.
1903-04	... 71.18	76 0 0	108 3 0	
1902-03	... 71.47	75 7 0	107 3 0	
1901-02	... 62.57	61 1 0	76 7 0	
1900-01	... 65.50	63 6 0	83 6 0	
1899-00	... 64.06	63 8 0	81 6 0	
1898-99	... 60.31	66 15 0	80 12 0	
1897-98	... 52.26	64 11 0	67 9 0	
1896-97	... 61.04	68 15 0	84 2 0	
1895-96	... 64.15	46 15 0	60 3 0	
1894-95	... 60.39	47 5 0	57 2 0	
1893-94	... 58.59	49 9 0	58 1 0	
1892-93	... 52.27	47 0 0	49 2 0	
1891-92	... 47.68	53 4 0	51 0 0	

and of this timber not 20 per cent is considered capable of yielding Europe squares, while of the quantity extracted by lessees the percentage is estimated at not more than 10 per cent at the outside.

23. Here the prices to be paid have been forced up by competition. In the first place no lessee can afford to allow a competing lessee to obtain timber at a public auction for less than the former can work it out himself. Non-working exporters are forced to pay high prices to obtain anything and to hamper existing lessees. All are interested in procuring as much timber calculated to yield Europe quality as possible, while outsiders bid heavily to endeavour to obtain a footing which has to be prevented by existing lessees paying more, and in many cases shippers are forced to buy at the time to make up their averages on consignment. Considering the loss on conversion estimated

On Europe squares at 25 per cent

 " Indian " " 10 "

On timber for local use 25 "

it is easy to calculate what the selling price of the converted material must be to give a decent profit.

24. The cost of working by so-called Government Agency, which consists in paying a contractor a fixed rate per cubic foot

for an average sized log and paying or deducting a small additional rate per cubic foot over or under this size in order to encourage the bringing out of large-sized logs, varies from Rs. 14 to Rs. 24 per ton for delivery at a shipping port and may be taken fairly accurately at Rs. 19 per ton all round so that selling at Rs. 76 seems to leave a very large margin of profit, but if a percentage for establishment, supervision, etc., as calculated for a private concern were added this profit would be considerably reduced.

25. We have now to see what can be done to remedy the present state of affairs and whether Government can do anything to render the market more stable; and the question that has to be asked is, "Is Government in the Forest Department as a Semi-Commercial Department going to be content with a fair average royalty on its produce as a perpetual investment or will it, with a view to making a larger profit for some years, risk the possible loss of the trade in question?" In connection with the high rates lately paid for certain timber made available the argument put forward for demanding or forcing them is that "the market value of anything is the price it will fetch in the open markets." This I allow, but only to a certain extent, and not in the present case, where other considerations have to be taken into account; whether rightly or wrongly the payment of high rates of royalty and heavy prices at auction will naturally be quoted as a set off against prices being forced up in the home market.

26. Competition we must have, but competition between private individuals among themselves and competition between these and Government are two entirely different matters. The latter has unlimited finances, the former not, and while Government is in the position of a competitor I am convinced that it can do little, while if the business is left entirely to private individuals their individuality alone must help to settle matters. Mind, Government must still maintain a controlling hand with a view to preventing what in America is termed a "corner" both as regards foreign and local supply, but beyond that I am of opinion that provided it safeguards its own interests private concerns can be left to look after themselves.

27. On the other hand one asks if the profits made by the Government on timber extracted by its own agents are so large why does not Government undertake the whole of the extraction and sell all extracted material to the timber traders in the open market? *Because it cannot.* It has not the staff nor the working power, and lessees have been too long in existence, being an acknowledged legacy of Burmese rule. Business organisations have been built up at enormous cost and trouble, and are intimately connected with the interior development of the country, and the withdrawal of the largely invested capital would undoubtedly affect its prosperity; as it must not for one moment be imagined that the stopping of the purchase contract system would result in the working power being thrown into the hands of Government. The major portion would be transferred for similar work elsewhere, and in all probability a very large amount of invested capital in other directions would also disappear and a very large number of the inhabitants be thrown out of work, many of whom would be unfitted for any other occupation.

28. What appears to be the case at present is that Government has created a monopoly which has forced prices to an extreme limit, a state of affairs that *under existing circumstances it seems powerless to alter.*

29. The following extract from a recent paper seems peculiarly appropriate :—

"The idea that low or uncertain prices are in any sense or degree a source of advantage to anybody in the long run has been abandoned by thoughtful economists and traders. What any branch of the trade must have to be steadily profitable is stability. What the body politic must have to be prosperous is profit, and neither of these factors is attainable in the presence of declining or even sharply fluctuating values."

30. Two grounds for complaint are put forward by lessees concerned in existing purchase contracts as having an adverse influence on economical working, *viz.*—

(1) The short period for which these purchase contracts are granted and the non-guarantee of renewal, both of which are

undoubtedly well founded. The longest period for which existing purchase contracts run is 10 years, *viz.*, 1901 to 1910, while others were only issued in 1905, to expire also in 1910. In the latter case it is manifest that full advantage cannot be taken of the natural method of extraction by water. The fear of forfeiture of unextracted logs and fines for non-extraction necessitate this being assisted by carting and other means, and as the former is only practicable in favourable localities during the hot season the strain on animals is great and casualties heavy; while (11) the non-guarantee of continuous work militates against expenditure on permanent improvements both of roads and watercourses which might also under the existing system be of more ultimate benefit to a competitor. In another way also a guarantee, under suitable conditions of course, would be beneficial in that a fore-knowledge of it or of other areas likely to be thrown open would allow of the gradual organisation of the establishment and power necessary to work it, while at present this has to be hurriedly collected and at the termination of the contract possibly as hurriedly disbanded or transferred, all of which means more expense; in addition to which the endeavours to extract as much as possible during the last year or two cause a serious drop in the revenue for the first few years of a new contract.

31. If we now compare the two systems of workings, *i.e.*, that under the purchase-contract system and that of departmental working, we find in favour of the former—

- (1) Relief to an unmanned department in a reduction of organisation and clerical work allowing of more time being devoted to works of improvement.
- (2) A more complete working of the forests, all marketable produce being extracted at the same time.
- (3) Less risk of failure of the produce coming to hand in time, as if a Government contractor's elephants die or he himself gets ill work at once comes to a standstill and is not completed that year.
- (4) A more accurate estimate of the annual revenue (which would probably steadily increase) can be framed.

(5) General assistance to Government in opening up the country.

While in favour of the latter, *i.e.*, extraction by Government agency, we have only a larger profit to Government on the material extracted and sold, which however, as we have seen, may be only temporary.

32. Having virtually established the fact that at all events the major causes combining to the present high price of teak are—

(a) The shortness of supplies, more especially of timber of Europe quality ;

(b) The increased cost of extraction and higher prices ruling in the provincial market ; and

(c) The increase of royalty under purchase contracts— it remains to suggest remedial measures. In view of the fact that since this article was commenced a conference of the Conservators in the Province has been ordered to discuss this subject it is perhaps premature to make suggestions here, but, as a previous consideration of such as the writer is prepared to forward may possibly shorten the labours of the conference in question, it may be advisable to do so.

33. As regards (a) the shortness of supply. It is only natural that this must tend to increase prices which an increase of supplies would naturally lower; but can this be effected? I believe if necessary it can. The formation of working plans, however, cannot proceed faster than at present, but in the majority of those framed during recent years it has been found that there is a surplus stock on the ground the extraction of which, in order to avoid too serious a drop in revenue at the end of the first period, *i.e.*, some 30 years hence, has been spread over two periods, *i.e.*, 60 years. In view of the fact that a very much more serious drop may occur within a much shorter period by the ousting of Burma teak from the market, would it not be as well to proceed with the extraction of this surplus within a shorter period? In addition the girdling operations in reserves for which working plans have not yet been prepared might be slightly and

cautiously increased with a view to the supply of first class timber only as it is probable that the same state of affairs will be found here, *viz.*, a surplus on the ground and up to the present in the areas already girdled over as much of the first class stock as possible has been left standing; of course if it was found that such action was detrimental to the future welfare of the forests it would have to cease, but the present girdling operations over these areas have been framed on very meagre examination and statistics.

34. Further, in those localities where it is found that departmental extraction is unable to cope *to the full* with the amount of material available departmental extraction might be restricted to a smaller area and the remainder given out on purchase contracts. We have already seen that by the latter all marketable produce is more quickly removed, and it is possible that the increased outturn will considerably help to make up any deficiency in the diminution of profits under the extraction by departmental agency should such be reduced. With a view to reducing the cost of extraction by lessees, purchase contracts for longer periods might be issued with a guarantee of renewal provided work was satisfactory; while in the case of a proposed change in the rate of royalty or of new areas being thrown open arrangements for their working might be made some two years at least beforehand to allow of gradual organisation; and instead of at the last moment putting either girdled timber or new areas up to public tender. These might be allotted at a *fair* rate of royalty to different existing lessees in proportion to their capability and working power or to new-comers who have satisfied a full enquiry into their financial position and power of satisfactory working.

35. Under the last head (*c*) it is almost impossible to make any suggestion. It would seem at first sight, considering that we are also working departmentally, easy to fix a rate of royalty based on cost of extraction and market value, but although it has been attempted for many years no satisfactory solution has yet been found. It is quite impossible, although dividends are annually declared, to obtain any idea of the amount of capital invested, and I very much doubt if any private concern would

care to have it accurately known. In any case I am of opinion that very little improvement can be attained by a consideration of any of these three factors separately, and even considered together it is impossible to predict the ultimate result of the adoption of the above suggestions.

36. In writing the above I must disclaim any special commercial knowledge or training which if I possessed might place me in a better position to discuss the financial aspects of the case. I can only lay claim to 25 years' continuous service in the Province, during the whole of which time I have been in close contact with the working of the forests in all parts under both systems, and have had constant opportunities of discussing the subject from all points of view with nearly every one connected with the trade; and I can only say the facts are there; the conclusions I have drawn may be correct or not, while I must leave the solution of the question to others and to the future.

NOTE.—Since the above was written the following further information bearing on the subject has been obtained from the report on the trade of Bangkok for the year 1904 by Mr. Acting Consul Lyle.

During the year under review 77,531 tons of teak valued at £560,174 were exported as compared with 1903. These figures show an increase of 19,385 tons over the exports during 1903 and of 29,450 tons over and above the average exports of the years 1899—1903.

The exports were declared as follows :—

	Tons.
For the United Kingdom	... 1,355
" India	... 43,785
" Europe (exclusive of the United Kingdom)	11,104
" other countries	... 21,284

Some 138,000 tons arrived at the Revenue Station during the year, but of this not more than about 10 per cent is considered of Europe quality; 60 per cent fit for the Indian and other Eastern markets, while the remaining 30 per cent would be converted into

building material for local use. It is anticipated that owing to shortness of supplies within the next three or four years this output will fall to 35,000 tons annually at the most, as the more remote forests from which the waterways drain into the Mekong are reported, even with the present high prices prevailing, to be too inaccessible and costly to work.

The present local value in Bangkok of timber of European quality is quoted at £8 to £10 for squares and £9 to £12 for planks.

If these predictions are fulfilled it will diminish the competition against Burma teak and may lead to the diversion of working power and capital from Siam to Burma.

T. A. H.

NOTE ON THE GERMINATION OF TEAK AND OTHER SEEDS.

BY R. S. PEARSON, I.F.S.

Some Notes on this subject submitted by me to the Conservator of Forests, Northern Circle, Bombay, were forwarded by that officer and published in the March, 1905, number of the *Indian Forester*. Having again had the opportunity of watching the germination of various species of seeds, under various conditions, in the Central Nursery of this division, it may be of interest to add some further remarks to my last Note on this subject.

On page 169 of this volume are given three methods by which it was attempted to accelerate the germination of teak seed, and method No. II, called the "Modified Burman Method," is shown as having given by far the best results.

This year similar experiments were made, but with much poorer results. Soon after the prepared seed was sown in the seed beds there were two abnormally heavy falls of rain, one on the 9th July, which gave 10 inches, and another on the 22nd, 23rd and 24th, giving a total of 16 inches. On both these occasions the raised seed beds were flooded and stood for a considerable time under water. To this flooding may partly be put down the failure

to make the seed germinate. The other circumstance which probably helped towards the bad results was that the seed was not fermented sufficiently during preparation.

The seed treated according to method II was watered and mixed the same number of times and in the same way as last year, when excellent results were obtained, but this did not bring it to a sufficiently advanced stage to germinate readily on sowing, and it still required longer treatment. My camp was in districts at the time, and the mali in charge got alarmed by seeing a few seeds at the top of the mass showing signs of germinating, and, fearing to spoil the seed, stopped watering, though the bulk of the seed was really still below germinating point. The first reason given for failure is the flooding of the beds, the result of which was to subject the seed taken from the warm moist earth of the germinating pits to a prolonged cold bath when on the point of germination, and matters were not improved by a month of sunless weather during which the soil in which the seed was sown never got a chance of warming up again.

The second reason given is insufficient preparation of the seed in the germinating pits. The exact point to which the process should be carried can only be found by careful observation and experience. I am, however, of opinion that it is better to carry it a little too far and chance losing a few seeds than to underforce germination, and so fail to raise the required number of seedlings, besides probably spoiling the seed for next year.

To form a rough estimate of the relative success obtained under method II this and last year it may be stated that with approximately the same seed-bed area and the same quantity of seed, only 15,000 seedlings have so far been raised against 50,000 last year, the seed in both cases being collected from the same area, and apparently of equal quality. The shortage of seedlings this year is serious in that there are not sufficient plants to fill the transplant beds in the nursery. To remedy this, attempts are now being made to start the seed germinating again. The weather being fine and hot, the earth in the beds has become dry and warm, and they are now being watered on alternate days, as is done in

method II. This has set up a state of conditions somewhat similar to that when seed is in the germinating pits, *i.e.*, alternate heat and cold resulting in very damp warm earth, and though the earth in the seed beds does not approach the very hot damp heat of the seed pit, it has had the same effect, though modified, and the seed has again started to germinate fairly freely.

To the three sets of seed treated by the three methods before described, four more sets of seed sown under different conditions have been tried. They consist of (1) this year's seed unprepared, (2) seed two years old also unprepared, (3) seed subjected to a slight grass and leaf fire, similar to a January forest fire in a dry teak zone, (4) seed subjected to a severe grass fire, similar to a May fire. All four sets of seed were subjected to heavy rain and flood as described above. Of number (1) no seeds came up; of number (2) only 18 or 20. This is curious as all previous observations have shown two-year-old seed to germinate well. Number (3) shows by far the best results, and with watering new seedlings are daily appearing. Number (4) produced nothing.

The experiments on the whole have shown poor results compared with last year, but it is hoped to again try such experiments especially with seed subjected to a light fire, as if it is true that a slight fire sets up conditions which help towards germination, it might possibly be another helping factor in the better regeneration of certain fire-burnt areas in Burma. As regards other seeds, the most interesting point arrived at is the successful results in making dhawra (*Anogeissus latifolia*) germinate. In my former note I stated my incapability to make dhawra germinate satisfactorily. This has been overcome by sowing the seed on well irrigated raised beds, the soil being mixed with a large quantity of coarse sand, the seed sown in June, and daily lightly watered by hand. The reason for trying a very coarse sandy bed was that most excellent natural regeneration of dhawra was found in the Sampa jungles of this division, on the top and slopes of rocky ridges, the soil being of a coarse sandy nature, formed by the disintegration of a granite, containing a high percentage of large felspar crystals. These ridges were naturally well drained and the soil covered by an open crop

of mixed jungle, containing, amongst other species, dhawra. At first the seed could not be made to germinate in the seed beds, and not until about 20 days after sowing was there any sign of germination. It was then seen at one end of one of the beds which was heavily shaded by the branch of a tree. Only one or two seeds germinated in the other part of the beds, nor was the number much increased, though watering went on for a fortnight. I then covered one of the beds with a thick covering of leaves and branches some 18 inches above the ground, so as to form fairly dense shade, and within three days there were a mass of seedlings coming up, the other beds remaining in practically the same state as before.* I have little to add regarding other species. The only new species sown was Nirmali (*Strychnos potatorum*), which is much used in these parts for cart shafts. It took six weeks after sowing to germinate. The seed when commencing germination forms two very delicate light-green cotyledons, embedded in a milky-white horny endosperm, which they absorb before breaking through the testa. The radicle is soft, white, and easily broken if the seedling is disturbed before becoming fit to transplant.

The results of the plantations are satisfactory; an acre of pure teak plantation when counted gave in its third year 21 per cent of failure, which taking into consideration the locality and rainfall is fair. The transplanting of small khair (*Acacia catechu*) has been found to be extremely difficult, as many fail, and it is doubtful if it is worth the expense. The only results at all favourable with khair are those when carried out with large plants. Teak plantations are most successful, those of Bia (*Pterocarpus marsupium*) and sewan (*Gmelina arborea*) come next, dhawra and Ain (*Terminalia tomentosa*) next, and for khair I would recommend direct sowing as is done with Babul.

A photograph of the Central Nursery, Godhra, is sent herewith (*vide frontispiece*), and may be of interest.

* The dhawra seed failed entirely at Godhra last year. This year our dhawra at Bandra failed. Our Bandra experiments may perhaps be reported later. My object is to show how little is our sylvicultural knowledge, and to incite others to help in elucidating problems of natural regeneration.—(*Note by F. Gleadow.*)

CORRESPONDENCE.

THE MEMORIAL TO H. C. HILL.

As desired by the subscribers to the fund in memory of the late Mr. H. C. Hill, a bronze tablet has been placed in the Library of the Forest School at Dehra, and arrangements are being made to buy with the remaining money Government paper to provide an annual prize for sylviculture at the School. This prize should amount to a little over Rs. 40.

I have heard from time to time from different officers that they had not been apprised of the raising of this fund. I regret that this should have been so, but it was accidental. I first wrote a letter to the *Indian Forester* and asked all subscribers to the magazine who wished to subscribe to the fund to communicate with me. I then examined the list of subscribers to the magazine and wrote to all others that I could think of who were not on this list. I could only assume that if a subscriber of the *Indian Forester* had not written in response to my letter he did not wish to subscribe to the fund; but it appeared afterwards that some had missed my letter in the magazine. I now write this letter in case there should be still others who would like to subscribe, and, if so, I see no reason why subscriptions should not at any time be added to the fund, which it is intended to vest in the Director of the School *ex officio*.

DEHRA DUN :

October 9th, 1905.

A. G. HOBART-HAMPDEN.

FIRE PROTECTION AND OTHER MATTERS.

Mr. E. M. Hodgson has thought it worth while to contradict my remark to the effect that man with his fires, cutting, and grazing is principally responsible for the wretched forests of pure teak along the west coast north of Bombay. It is true he confines his remarks to the Surat Division, because it is the only one he has ever held. He knows it better than I do, although I too

held it for about a couple of years. He appears to credit me with ignorance of the elementary fact that soils influence crops, sometimes greatly. But, allowing for this great influence, I desire to point out that the effect of man's action is not a thing that remained to be discovered or imagined in the Surat Division, but is known to be of the deepest import all over the world. The Mandvi soils doubtless tend to the preference of teak or junglewood, as the case may be, but they would assuredly not show such marked differences without the action of man, which tends to the extermination of any species that finds its position naturally one of difficulty. Given a difficulty of serious dimensions, it is man who makes the forest one of pure teak or pure junglewoods according to circumstances, and generally a miserable forest in either case. As for "*natural*" forests, one may often find them with little or no teak, but a "*natural*" forest of pure teak is a thing that scarcely comes within my experience.

20th September, 1905.

F. GLEADOW.

REVIEWS AND TRANSLATIONS

THE MYSORE ADMINISTRATION REPORT FOR 1903-04.

During the past two years some attention has been paid in these pages to the forest conditions and management of the Mysore State, and the present method of dealing with the valuable sandal wood tree has formed the subject of certain remarks. It was pointed out last year that it was practically impossible to ascertain from the report what was the actual value of the forests or what real progress was being made in their protection, management and amelioration so long as the revenue derived from such a purely commercial branch of forestry as is the work in connection with the sandal was mixed up with the other sources of revenue.

Turning to the financial results of the year under review we find that the gross revenue rose to Rs. 15,90,761 as against Rs. 14,77,656 of the previous year. The expenditure was Rs. 5,18,121 as against

Rs. 4,80,061 in 1902-03, the net surplus being Rs. 10,72,640, a very nice little present indeed to make to the Mysore Treasury. It will be instructive to examine how such excellent results (financially) are obtained, for there can be little doubt ^{as} the score of the commercial prosperity, we would not add financial stability, of what has become the Mysore State Lumbering Department. If we examine the above figures more closely we find that out of the gross revenue of Rs. 14,77,656, Rs. 10,26,470 was derived from the sale of sandal wood, the expenditure on the cost of extraction and preparation of this wood being Rs. 54,203.. These figures speak for themselves without further comment being necessary. The dead sandal trees cannot last for ever, and as no attempt is evidently being made to regulate the cuttings of this tree so as to obtain a more equitable and sustained annual yield and revenue, on the exhaustion of the dead trees this latter will find its real level, and the true position of the Mysore Forest Department as a revenue concern will be disclosed. These dead trees themselves require some consideration. Many are the outcome of the disease known as "spike," whose origin remains at present undetermined. We confess to a feeling of considerable surprise at finding no evidence in the pages of the report that the Conservator is taking any steps to solve what is the most important problem, as far as the continuance of his mere revenue is concerned, of the Mysore forests. Allowing the trees to die and then cutting them out to make money scarcely gives evidence of high administrative qualities. *Cucullus non facit monachum.* It is true that both Dr. Butler, Cryptogamic Botanist to the Government of India, and Mr. Barber, Economic Botanist to the Government of Madras, have toured in Mysore and made examinations of diseased trees, but the services of these officers were only lent for a short time, and their examinations can at the best have been but cursory ones. Neither of these specialists can spare the time to devote to a problem of a Native State which is outside of their legitimate sphere. The Conservator writes "The whole matter requires careful, steady, and close observation for a series of years before any definite conclusions can be arrived at. The preventive measures

already inaugurated will be continued in the meantime with unabated vigour and the results carefully watched." Under these preventive, we had almost written primitive, measures we note that 24,300 "spiked" trees were uprooted during the year and their marketable wood sold. To solve the "spike" problem would no doubt lessen this source of revenue. Has the Conservator ever considered the question of the entertainment of a specialist for from six months to a year whose sole work would be to study the spike problem? We would recommend if he wishes to save his sandal forests and not deliver them all over to the axe to lay this matter at an early date before his Government.

Having considered the sandal question apart from the rest of the forest work, as we have already suggested should be done in the Conservator's Annual Report, we may now turn to the Mysore forests proper.

From the gross revenue realised we find that only one-third or Rs. 5,64,291 is the actual amount realised from the Mysore forests, and against this an expenditure of Rs. 4,63,918 has to be placed, leaving a sum of Rs. 1,00,000 as the actual revenue of the year. Looked at from this point of view the working of the Mysore forests scarcely compares favourably with those in other parts of India. And yet both from a professional and a financial standpoint this is the only true way to get at the real state of affairs. The presence of the sandal is more or less of an accident and should be treated as such, and the progress made in the real forests could then be gauged at its true value.

No working plans were drawn up during the year, and the operations under the sanctioned plans do not, from the report, appear to have been particularly favourable, much of the prescribed fellings remaining undone. Little attention appears to be paid to roads and buildings, a sum of Rs. 9,732 only being expended on the former and Rs. 12,009 on the latter. Some of even this small amount was incurred on account of sandal work.

In the prosecution of offenders the results obtained are very poor; and this is perhaps scarcely surprising when we find the following in the report: "The Conservator cannot help noticing

that notwithstanding repeated admonitions few or no District Forest Officers take any interest in the prosecution of forest cases." We wonder whose duty it is to see that they do take interest! It would be interesting to read the remarks of the Government of India if one of their Conservators made a similar complaint.

We are glad to read that an area of 50 acres in the Jagur Valley in the Kadur District has been planted up with 31,548 teak seedlings. The plants are reported to be doing well. Other cultural operations are said to be carried out, but the details given are scarcely sufficient to enable a satisfactory estimate to be formed of the actual success attained.

The valuable evergreen forests of the Shimoga Ghats were exploited for the first time during the year, and a large quantity of timber (we quote the Conservator) consisting of Hopea parviflora and ebony felled under the "selection system" and supplied to a contractor, Mr. Hajee Ismail Sait. We gather from the report that this contractor is a personage of some importance in the Mysore forests. It may be pointed out that experience has shown that the employment of one big contractor in the forest is usually to be deprecated. The advantages are liable to be all on the one side. With several competing contractors it is usually possible to get rid of the bad with the good trees and not only select the best in the forest in the most suitable localities for easy exportation. We understand that a large demand for mine timber has arisen in the Kolar Goldfields. With such a demand to supply contractors should be numerous, and to allow a monopoly is not the way to attract merchants to the forests. Another question which crops up in exploiting virgin forest is the question of selecting the trees for marking, and we are glad to see that such trees are invariably marked by a gazetted Officer or a Ranger under the guidance of the District Forest Officer which we presume is the same thing.

Of the small revenue realized from the forests we note that half a lakh of rupees were derived from grazing. The professional Forest Officer, whilst always ready to see that the wants of the surrounding inhabitants are fully supplied in this respect, is

invariably happier when the number of cattle in his forests is small. The case is otherwise in Mysore: "The revenue realised during the year from grazing shows a satisfactory increase..... As compared with 1901-02 the increase is Rs. 12,223, or in other words, the revenue rose in two years by 33 per cent."

Allusion has been already made in these pages to the peculiar epidemic which broke out amongst the elephants and cattle in Mysore in the first months of the year 1904. Three valuable elephants were lost to the department under the disease, which was not confined to domestic animals but killed off a considerable number of wild animals including elephants.

We read with unfeigned pleasure that the Mysore Government is following the enlightened methods now in vogue, and has ordered the reservation of certain forests as special game sanctuaries. Shooting in these preserves is prohibited without the special sanction of the Maharaja.

FOREST ADMINISTRATION IN THE FEDERATED MALAY STATES IN 1904.

The forests under the charge of the Conservator are situated in the States of Perak, Selangor, Negeri Sembilan and Pahang, and comprise at present a total area of 259,020 acres or 4049 square miles, the percentage of reserves to the total area of the States being 8·34. Considerable areas still remain for reservation.

A good deal of forest exploration work was carried out by Mr. Phillips, Assistant Conservator, in the Temerloh and Rompin districts, which resulted in the finding of large tracts of *chengal merban* (*Afzelia palembanica*) and *resak* (*Shorea barbata*), etc. Another block of Camphor (*Dryobalanops camphora*) was found in Rompin.

With reference to survey operations the Conservator remarks that the whole of this question is difficult in the States, as natural features are rarely available as boundaries, and in many places a high degree of accuracy is thought to be necessary.

The working plan for the Matang mangrove forests was adhered to and certain areas disposed of on tender, approximately

57,939 tons being cut. There are no working plans in Selangor or Negri Sembilan. In Pahang fellings are regulated by the imposition of a marking fee, each tree being marked by a Deputy Ranger before felling, a minimum girth limit of 6ft. being adhered to and two trees left in every five.

During the year quarters were built by the Public Works Department for the Conservator and Deputy Conservator, Selangor, at Kuala Lumpur, and for an Assistant Conservator at Kajang. Eight new checking stations were also erected in Selangor. The same number were put up in Negri Sembilan, and 15 more in Pahang. Five Rangers' quarters were also put up in the last named two States.

The protection of the forests is as yet in an elementary stage since the majority of the staff have their hands full with roads, checking and measuring timber, &c. The general protective staff consists of Rangers, Deputy Rangers and a few Forest watchmen. Raiding of gutta-percha forests by Dyaks in the Ulu Tembeling in Pahang has proved a source of trouble, and this has led to a strengthening of the staff in that direction. Forest fires are practically unknown.

A Draft Forest Enactment on the lines of the Burma Forest Enactment was drawn up by the Conservator, and is now under consideration.

Forest offences resulted in a fair proportion of convictions, and the forest laws are said to have been enforced all over the State with greater uniformity than heretofore with good results.

The remarks on natural reproduction are of interest. In Selangor *merbau* (*Afzelia palembanica*) seeded very plentifully during the year, thousands of seedlings being observed; *penak* also seeded well. A few gutta-percha (*Palaquium oblongifolium*) seeds were obtained from Mr. Harper, fruiting trees having been found by coolies in the remoter jungles. The natural regeneration of this tree is said to be good. The dipterocarp family also fruited well, and especially in Negri Sembilan; large quantities of *penak* seeds were collected in this State.

The reproduction of shoreas is said to have been good. A considerable amount of plantation and nursery work and cultural operations is in hand. The plantations contain *rambong* (*ficus*) and Para rubber, casuarina, camphor, mahagony, *merban*, *penak* and *palaquium*.

Seventy-one thousand eight hundred and ninety-three tons of timber and fuel were removed from the reserves on the royalty system and 659,952 tons of 50 cubic feet measurement were taken out for the mines; on this latter timber no royalty is realised. The great increase is due to railway construction, 96,000 sleepers being supplied from the State forests. These consisted chiefly of *penak* and *kumus* (*Shorea* sp.). Some of these sleepers had to be carted a distance of 31 miles. The price paid by the Railway Department was from \$1.60 to \$1.70 for *merban* sleepers, and \$1.80 for *penak* sleepers. The average cost per sleeper in Perak was about \$1.30.

Nearly all the timber is exported to Singapore, and consists of *merban*, *chengal*, *balan* (*Shorea ridleyi*) and *giam*.

The estimated value of the timber and firewood cut for mines taken at a low valuation of \$7.50 per ton = \$494,964 as compared with \$472,777 in 1903. This is given free and a share of the opium duty credited to the Department in its stead, a curiously anomalous exchange. This share only amounted to \$159,120, so the Department was a loser by a considerable margin over this peculiar transaction. As pointed out by the Conservator, since the miners are allowed to cut free one would think that the compensation paid to the Department should come from the export duty on the tin from the mines and not on opium, which is consumed by others in addition to the miners; in other words, that a proper equivalent for the wood cut free should be credited to the forests from the large tin revenue. As nearly the whole of the mine timber has to be inspected by the Forest staff, which entails the upkeep of a large *personnel* solely for this purpose, it would seem to be a fairer procedure were the miners made to pay for this extra establishment.

On getah, i.e., jungle rubbers, chiefly 'getah gerit' (*Urceola* and *Willoughbieia*), india rubber derived from the above-named

climbers—\$11,500 was collected in royalty and \$11,110 in export duty as compared with \$871 and \$12,400 in 1903, or nearly double, of which over \$17,000 was collected in Pahang.

The minor produce consists chiefly of bertams, ataps, damar wood-oil, resins, &c. It resulted in \$16,818 royalty and \$32,265 export duty being realised. The damar trade is extracted chiefly from *penak* and *kumus*; also from *Hopea globosa*. The last named yields the true damar mata kuching.

The revenue for the four States amounted to \$589,707·67 as compared with \$509,634 in 1903 and \$288,053 in 1902. The chief increases were in timber, firewood and charcoal, bamboos and canes, and jungle rubbers.

The total expenditure was \$219,888 as compared with \$202,069 in 1903, the net surplus being \$373,412.

Mr. A. M. Burn Murdoch, the Conservator, to whom we are indebted for the above interesting report, was transferred permanently from the Imperial Forest Service of India to the Service of the Straits Settlements and Federated Malay States with effect from the 1st January 1904.

CURRENT LITERATURE.

In the FOREST QUARTERLY for May, Mr. W. F. Hubbard describes, under the title of An Adaptation of Methods in Forest Work, a method by which valuation surveys were made in a forest in which the strip acre system was not practicable owing to the forest being in parts very open, due to logging operations, whilst in others the young trees occurred in dense groups or in long narrow strips. 'After experiment it was decided to run a series of cruisings which would give an actual tally of the trees on the tract. After laying out a base line through the middle of the tract stations at ten-chain intervals were laid off in each section and numbered consecutively from the western corner of each section. From these stations the cruisings were run north and south. Two men were used in the work, one carrying the chain and compass, the other tallying the trees. The tally unit was an area

of five chains on each side of the compass man and ten chains long—equal to 10 acres.' Under the title of the Minnesota Experiment, Mr. G. B. Elliott doubts the possibility of reproducing that forest by natural regeneration from the seed-bearers left, and considers that the area should be planted up. In an editorial comment on this article, Mr. B. E. Farnow shows that he is not in agreement with the author. Mr. E. Bruncken has an article on Damages for Injuries to Forest Property, which is followed by a lengthier one on 'Considerations in Appraising Damage to Forest Property' by the Editor, in which the legal aspects are discussed in a clear manner.

THE BOTANICAL GAZETTE for September contains several papers of very considerable interest. A. F. Blakesler writes upon two conidia-bearing fungi Cunninghamella and Thamnocephalis, n. gen., and D. M. Mothier gives a preliminary notice of the 'Development of the heterotypic chromosomes in pollen mother cells.' The Relation of Transpiration to growth is considered in an instructive paper by B. E. Livingstone, whilst the 'Rusts on Compositæ' by J. C. Arthur is followed by a paper on a Morphological Study of *Ulmus Americana* by C. H. Shattrick of the Hull Botanical Laboratory. This investigation, in addition to its botanical interest, is not without value to the forester. It is followed by two briefer articles on 'Preliminary Leaf Serrations of *Ulmus*' by F. H. Billings, and 'The Effect of different soils on the development of the Carnation Rust' by J. L. Sheldon.

The 'Results of Experimental Tappings of *Hevea brasiliensis*' is the subject of an article in the AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES. This note is a translation from the article on the subject written in Dutch by Dr. W. R. Tromp De Haas, the experiments having been carried out at the Economic Gardens at Tjikeumeuh (Java) between 1900—04. The system practised was coagulating with alcohol, which, though of interest, is, owing to its expense, not commercially practicable. The author lays stress on the fact that the dryness resulting from sun and wind interferes with tapping. Also that the sites selected for plantations should have a sufficiently humid

soil. A most interesting article is that dealing with the 'History and Development of Agriculture in the Malay Peninsula.' Elsewhere we give Mr. Ridley's description of how the Botanic Gardens originated. He divides the history of the progress of agriculture in the Malay Peninsula into three agricultural periods, both for European and Native cultivations, as follows:—

	EUROPEAN.	NATIVE.
A	1800 to 1860, Nutmegs and Cloves.	Pepper and Gambier.
B	1875 to 1898, Liberian Coffee.	Tapioca and Indigo.
C	1896 to 1905, Rubber.	Pineapples.

Sugar and cocoanuts (European cultivation mainly), Sago and betul-nuts (native cultivation), were successfully cultivated all through these periods. The first thing noticeable is that the European cultivations were all exotic and that the characteristic cultivated plants were all introduced by the Botanic Gardens of the period—nutmegs and cloves by Christopher Smith in the first Penang Gardens; Liberian coffee and rubber by Murton in the Botanic Gardens at Singapore. It appeared that Europeans were never really successful with plants cultivated by natives and *vice versa*. The native however took up two cultivations abandoned by Europeans—(1) Spices, abandoned in 1860 owing to disease, are still cultivated in Penang and Province Wellesley; (2) Pineapple cultivation for tinning is now entirely in the hands of Chinese.

In the WEST INDIAN BULLETIN for August an article deals with the Results of Experiments in the Cultivation of Cotton in the West Indies, the fungoid and insect pests of the plant being considered by experts in supplementary papers. There is also an interesting note on the cultivation of rubber (*Castilloa*) in the West Indies.

The Department of Land Records and Agriculture, Bombay have issued a BULLETIN, No. 25, on Sugarcane by Mr. B. Knight, Professor of Agriculture. The Note deals with the cultivation, harvesting, milling and boiling. Also profits to be obtained. A

few words are given on the subject of the fungus and insect pests to which the cane is liable.

FORESTRY AND IRRIGATION for August opens with a frontispiece depicting Redwood logging. The illustration shows a feller making the 'undercut' in a magnificent specimen of a red wood after which operation the saw is used.

The greater part of this number is devoted to a discussion of the forest and water problems of California. The plan has been adopted of dealing in one number with the forest problems of one particular State at a time, the July issue having been devoted to Connecticut. Gifford Pinchot leads the way with a short powerfully written article on the 'Forest Situation in California,' whilst others on the 'Work of the Reclamation Service,' by F. H. Newell, Chief Engineer, 'Reforesting in California,' by T. P. Lukens, follow. Forest Fires and the Forest in California is a well illustrated and interesting article by W. F. Hubbard. Other papers of considerable merit follow.

THE PROCEEDINGS OF THE AGRI-HORTICULTURAL SOCIETY OF MADRAS for the second quarter contain an interesting note upon two wonderful Hybrid cottons—Caravonica No. 1 wool cotton and Caravonica No. 2 silk cotton, both of which have been raised by Dr. Thomatis on his plantations in Cairns, North Queensland. Of this cotton the Superintendent writes: "Judging from the reports sent us by Dr. Thomatis and from articles published in the Australian papers it is or should be the cotton of the future, and being a 'Tree-Cotton' it should have a great advantage over the annual cottons now being grown by the ryots throughout the Presidency in the districts, of Madura and Tinnevelly." The note goes on to describe the parentage of the and the Australian comments upon them.

SHIKAR, TRAVEL, AND NATURAL HISTORY NOTES.

RESTOCKING STREAMS WITH TROUT.*

The artificial restocking of rivers and streams with trout can be accomplished by putting out young fish reared in some form of specially constructed closed apparatus, either at a central fishery station or close to the waters it is desired to re-populate.

The first plan results in a considerable mortality during the transport of the young fish from the central station ; and, later on, their immersion in streams which may vary very considerably in temperature, density, etc., from those of the central establishment will lead to a high death-rate.

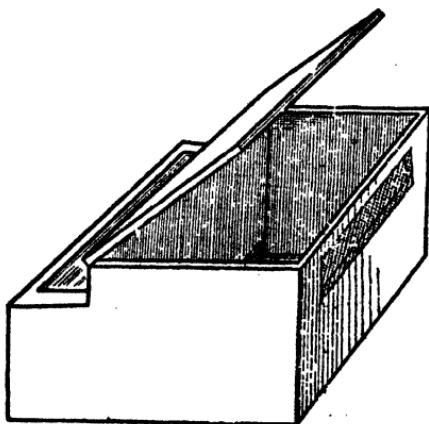


FIG. 1.

The second method appears to be the more advantageous one; experiments in connection with it have been made with various forms of apparatus in the Department of Cantal in France. The apparatus now in use, and which fully answers all requirements

*This is a very free translation, with additions, of a narticle by M. Volmerange in the *Revue des Eaux et Forêts*, 461, No. 15 (August), 1905.

and gives excellent results, is comparatively cheap to make and is very simple in its nature.

It consists of a wooden box (*vide* Fig. 1) containing two compartments of unequal size; the smaller which is filled with stones or charcoal, sponges, etc., serves as a filter, and is placed facing upstream. The second compartment, which is provided with a cover, is the chamber in which the ova are placed, and opens into the smaller one by means of an aperture of about 0·03 in height made in the wall which divides the two compartments.

The opposite wall has near the top an opening covered with wire gauze which allows the water to run through.

The ova are placed in this box on a bed of small stones.

The following are the dimensions of a box which will hatch out 1,000 trout ova:—

Filter ... Length 0·30 ; breadth 0·07 ; depth 0·10.

Incubating compartment ... Length 0·30 ; breadth 0·15 ; depth 0·15.

Thickness of wood ... 0·007 to 0·008.

The wire gauze net placed in the upper part of the wall and through which the water escapes is 0·30 in height and 0·30 in breadth.

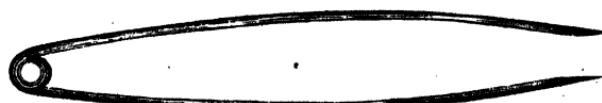


FIG. 2.

From the second year the inside of the wood of the box should be scorched out by passing a heated iron over it.

This apparatus, which, it will be seen, is extremely simple, can be placed in the hands of a forest guard or intelligent cooly or any one who takes an interest in the restocking of streams and waters with fish.

The only addition required is a small forceps, such as the one shown in Fig. 2, about 22 to 23 centimeters in length, by means of which the damaged and bad eggs can be picked out.

It will be obvious that such a box could be turned out at the cost of a few rupees, and its advocates state that in clear streams with a sufficient current it gives 90 per cent of results.

Both in the Nilgiris and, we believe, in Ceylon large sums of money have been spent in endeavouring to stock or restock streams with trout and other species of fish. I am not aware of the nature of the methods employed by the Nilgiri sportsmen to rear their fish, but if not in use the above simple apparatus, which I have personally seen working in France, may be thoroughly recommended a trial.

E. P. STEBBING.

EXTRACTS FROM OFFICIAL PAPERS.

OBITUARY.

MR. N. HEARLE, I. F. S.

We regret to announce the death in Cornwall of Mr. N. Hearle, late Conservator of Forests in India. Mr. Hearle received his training at Nancy, and was appointed to Burma in 1878. Here he became very ill, and was soon transferred to the United Provinces, with which he was identified, both as a Divisional Officer and a Conservator, for all his service, save for a short period, when he acted as Conservator in the Southern Circle of the Central Provinces. He retired after twenty years' service, and settled down in Cornwall, his own county, to which he was always greatly attached. He had been in ill health for many months, and died suddenly of heart disease on the 10th September last. All who knew him in India or at Home will mourn a friend of a singular simplicity and staunchness of character.

A METHOD OF IMPROVING THE DRINKING-WATER IN THE TARAI.*

BY W. H. MORELAND, C.I.E., I.C.S.

DIRECTOR, DEPARTMENT OF LAND RECORDS AND AGRICULTURE, UNITED
PROVINCES.

The improvement of the drinking-water in the tract of country known as the Tarai is a matter of importance from the agricultural point of view, inasmuch as the badness of the water is one of the principal causes why tenants are so hard to get and to keep. The general conditions of life in this tract may be briefly described as follows: The soil is as a rule fairly productive when effectively tilled, and there is no reason to doubt that many parts of it would flourish if an adequate resident population could be secured. But under existing conditions this is almost impossible: when a landholder has spent his money in settling a number of tenants and bringing part of a village under cultivation, a single bad year is usually sufficient to clear off most if not all of the tenants; some die, and the rest abscond. The unhealthiness of the life is really the main defect of this tract: specific diseases, of which malaria is the most common, account for most of the actual mortality, but the important point is that the people are never really in good health, and consequently they fall an easy prey to any disease that may make its appearance.

I cannot find any record of medical investigations into the causes of this chronic ill-health, but the people themselves are unanimous in blaming the drinking-water; and the following extracts show that this view is not based merely on prejudice. Thus the Settlement Officer of Shahjahanpur says of part of the northern tahsil of Pawayan: "The whole place is very unhealthy on account of the bad drinking-water. The Bhainsi (a stream) and all wells sunk near it are poisonous; it is only in a few places here and there that the water is fit to drink."

Similarly the Settlement Officer of Moradabad says of tahsil

*Published as Bulletin No. 20 of the Department of Land Records and Agriculture, United Provinces (1905).

Thakurdwara : "The climate is not good where the tarai influences it ; the excessive moisture and the bad drinking-water render fever prevalent."

Again, the Settlement Officer of Kheri wrote recently : "To the ordinary man the pargana (Pallia) is poisonous in the extreme. The water was so abominably bad that it was necessary to have it boiled before bathing in it ; and even after boiling it was so greasy and malodorous that powerful disinfectants were required to make a bath even tolerable."

On the same point I may quote the report of my supervisor, who conducted the investigations which are about to be described : "In this village of Jafirpur" (he writes from the Naini Tal tarai) "so long as I used the well water, my men and I always complained of bad digestion ; but when we began to use the pipe water, very soon the food is digested ; and this is also the opinion of my men."

There is no risk in concluding that water is injurious to drink when a European officer cannot stand it in his bath.

It was decided to begin the investigation of this question on the Government estates in the Naini Tal tarai, where the evil is very widespread. My supervisor, M. Ahmad Husain, was therefore deputed to this estate, with the ready assent of the Superintendent of the Tarai, and made a detailed and most intelligent study of about forty wells, taking trial borings where necessary. His enquiries showed that where the water was good it came in every case from a layer of clean sand, while the bad water was drawn from a layer of dark earth known locally as *zell*. The inference was drawn that this layer contaminated the water passing through it : the *zell* is of a blackish colour, with a bad smell when moist ; it shrinks by nearly one-half its bulk when dried, and swells again when moistened. Small samples of this soil were analysed by the Agricultural Chemist to the Government of India, and found to contain respectively 6·2 and 5·4 per cent of organic matter. Seeing that this layer of *zell* is now twenty feet or more below the surface of the ground, the objections to drawing water from it are obvious.

The investigations also showed that in nearly every case it was possible by carrying the well deeper to reach a plentiful supply of pure water: some way below the *lell* an impervious clay stratum is usually to be found, and below it a bed of water-bearing sand, analysis of which shows that it is a suitable source for drinking water. In the two cases referred to above where the *lell* contained 6·2 and 5·4 per cent of organic matter, the lower water-bearing strata contained only 0·32 and 0·15 respectively of organic matter. Thus on the whole it was clear that the bad water was due to the wells not having been sunk far enough, and that by going deeper good water was procurable.

In these circumstances one obvious remedy would be to close the existing wells and sink tube wells direct to the good water, with no possibility of contamination from the *lell*. But the habits and feelings of the people have to be considered: it is no use trying to force a novelty on people who are quite ready to leave the village at a day's notice, and whom you could not replace without much trouble and expense; and the people prefer the kind of well to which they are accustomed. It was decided therefore to alter the existing wells. This has now been done in the case of two wells situated eighteen miles apart, and the result is so promising that the method may be recommended for trial by all landholders whose villages suffer from the same defect.

The following is an outline of the process adopted: An iron pipe, two inches in diameter, is sunk through the bottom of the well, as in an ordinary boring, until the supply of pure water is struck. This water then rises into the existing well, and (in the case of the completed wells) in ample quantity. The well must then be so plugged that the *lell* water cannot get in: it must be thoroughly cleaned out, and a floor of concrete laid down with the pipe projecting through it. The masonry of the well-cylinder must also be carefully examined and the mortar renewed wherever it has given way, the object being to prevent water getting into the well from any source except the pipe. For the same reason the well should be provided with a platform above ground if one is not already in existence, and if the masonry of

the cylinder is seriously defective it may be desirable to surround it outside with a coat of well-puddled clay; or in exceptional cases to sink a new masonry cylinder inside, leaving a space of six inches between the old and new cylinders, which can be filled in with concrete when the new cylinder is sunk. The cost of these operations will naturally vary widely according to the condition of the cylinder; but for an ordinary well, six feet in diameter and in ordinary repair, the cost may be estimated at about Rs. 150 to Rs. 170.

The use of a two-inch pipe as described above will ordinarily yield an ample supply of water for all domestic purposes, but it will not give enough to serve for irrigation. If a well is wanted to serve both purposes, two courses are open: either the diameter of the pipe may be increased to four inches, or a narrow cylinder may be sunk inside the existing cylinder and carried down to the good water.

If a new well is to be sunk, the most important matter is to see that the cylinder is sunk at least ten feet below the bottom of the *lell*, and so far into a different stratum that the *lell* water cannot reach the well.

Landholders who desire to improve the water-supply of villages in the tarai or similar tracts are advised to have a trial boring made in every case, and in any case of difficulty to consult the supervisor employed by the department, who will give full instructions for the treatment of the well. Application for advice should be made in the first instance to the Assistant Director, Department of Land Records and Agriculture, Cawnpore.

MISCELLANEA.

THE HISTORY OF THE DEVELOPMENT OF AGRICULTURE IN THE MALAY PENINSULA.*

Our first records of what was cultivated in the Malay Peninsula date from the close of the sixteenth century, when the Portuguese were occupying Malacca. At that time and for centuries later what are now known as the Federated Malay States were entirely uncultivated trackless forest, as also were Singapore and Penang. They produced nothing but a little jungle produce and tin and gold.

Malacca, however, was an important port, and being often visited by travellers we have some account of its productions. Linschoten (1583) mentions in his "Voyage to the East Indies," as cultivated plants in Malacca, mangoes, cashew-nut (which he says had not long been introduced from America), Jambu (obviously from its description *Eugenia malaccensis*, "Jambus Bol"), Jambolanas (*Eugenia jambolana*), Bananas, cocoanuts, dutians, betel-nuts, sirih, black pepper, papaya, *Cana fistula* (*Cassia fistula*) and the shrub *Nyctanthes arbor-tristis*. Pineapples he mentions as having been brought not very long previously from Santa Cruz in Brazil to the West Indies and thence to India, and they were almost certainly cultivated in Malacca about that time. Chillies of several varieties were also cultivated in Malacca then (*Carcia da Orta Historia aromatum*). The only plant, however, which was cultivated at that time to any extent was black pepper, for the export of which Malacca was the great emporium. Rice was, of course, also cultivated, but only, it seems, for local consumption. Indeed it appears that this country, then and certainly later, did not produce enough rice for its population. It is probable that other plants were introduced during Portuguese occupation,

* The following notes are taken from an interesting article on 'The History and Development of Agriculture in the Malay Peninsula,' by Mr. H. N. Ridley, Director of the Botanic Gardens, S. S.

especially some of the fruit trees such as the Jujub (*Zizyphus jujuba*) and the Sapodilla (*Achras sapota*); but of this we have no definite proof.

No progress seems to have been made under Dutch rule, and indeed agriculture seems to have retrograded somewhat, as it is stated that, under Dutch administration, the natives were actually prohibited from growing rice.

Arabian coffee was probably introduced at this time, for it was introduced to Java by the Dutch Governor Van Hoorne in 1690 (Crawford's Dictionary), and doubtless soon found its way to Malacca.

A number of introduced plants bear in their Malay names the affix *Blanda* (Javanese *Wolanda*, i.e., Hollander), but this does not I think necessarily imply that the plants bearing this name were introduced by the Dutch as the word, now at least, merely means foreign. "*Nona Blanda*" (*Annona muricata*, the Sour Sop) and "*Chermei Blanda*" (*Eugenia uniflora*) are examples. The latter was introduced into Malacca from Brazil long after the Dutch had left the Peninsula.

The next development of cultivation followed on the settling of Penang by Captain Light in 1786. The Island, at that time, contained practically no cultivated plants except a few cocoanuts and fruit trees. Mr. Christopher Smith, the Botanist to the Honourable East India Company (1794), was appointed in 1796 to go to the Moluccas to collect spice-plants. He shipped off from there 71,266 nutmegs and 55,264 clove plants, and large quantities of seeds of the Canary-nut (*Canarium commune*) and Gomuti Palm (*Arenga saccharifera*). The greater part of these plants were sent to Penang, the rest to Kew, Calcutta, Madras, and the Cape of Good Hope.

He was appointed sole Superintendent of the Botanic Gardens of Penang in 1806, and is said to have died there about the same year.

He was also a botanist, and collected plants and made drawings of them, which are now in the British Museum. Cinnamon and pepper were also planted in Penang about this time, and

from 1803 to 1820 there was a great development of the spice cultivation, which continued till 1860, when the destruction of the nutmeg trees by disease, especially in Singapore, checked the cultivation. In Penang, however, the cultivation never died out as it did further south, but passed into the hands of natives, who maintain it to this day. The descendants of Smith's trees still produce the most valued nutmegs and cloves in the world. Gambier was introduced in Penang, in 1807, but it was cultivated to a much larger extent on the mainland.

Thus things remained till Sir Stamford Raffles, in 1819, founded Singapore. He was one of the few people in those early days who realised the importance of agriculture, and of introducing new and valuable plants. He introduced nutmegs and cloves to Singapore as early as 1819 and planted them as well as cocoa in the first Batanic Garden in Singapore, in 1823.

He writes to Marsden, in January 31st of that year: "I am laying out a botanic and experimental garden," and to Dr. Wallich (February 8th): "The Botanic Garden goes on well. I am now employed in laying out the walks and stones are collected for a handsome hand rail way round it." ("Memoirs" by his widow, pp. 535, 537.) This garden was on the slopes of Fort Canning, which was then the Governor's residence. A gardener named Dunn had arrived in Singapore previously in 1819, with letters of recommendation from Raffles and a supply of spice-plants.

Buckley, in his "Anecdotal History of Singapore," Vol. I, p. 74, states that Botanical Gardens were established and that Dr. Wallich was appointed Superintendent, and that Raffles gave him 48 acres more land for the Gardens and Government House ground, and a grant of 48 acres was given from the Government House garden in 1822 to the Superintendent and his successors to the north-east of the hill. This, as will be seen from Raffles' letter above quoted, is incorrect. The gardens were commenced in 1822; Dr. Wallich, though he doubtless took much interest in the gardens, was not Superintendent of it, strictly speaking, as he had only come down from Calcutta to recuperate after his

Nepal trip, and returned to Calcutta January 1823. Raffles left Singapore in June of the same year. Wallich seems to have promised to send a Superintendent for the gardens from Calcutta, but it is not certain whether he did so. The monthly vote for the upkeep of the Botanic Gardens then was 60 dollars. As happened with so many of Raffles' plans for the development of the Colony, the gardens seem to have been neglected as soon as he retired, and were abolished altogether in 1829 by Lord William Bentinck, the Governor-General, a man who seemed possessed with the mania of retrenchment. Ten convicts, however, were employed to keep the ground in order (Buckley, p. 206). I have been quite unable to find any trace of this garden now.

In 1822, the Botanic Gardens at Ayer Hitam in Penang were founded, but I am not sure whether they were on the site of Christopher Smith's original spice gardens, or when the latter ceased to exist. The Ayer Hitam Gardens were put under the charge of George Porter, a schoolmaster with a taste for botany, who sent many specimens of Penang plants to Wallich, which were distributed in the Wallichian Collections. Porter remained there in charge till 1834, when the gardens were sold by Governor Murchison for 1,250 rupees. The importance of Botanic Gardens in the early part of last century does not appear to have been understood by the Governors of Singapore and Penang, and it is stated that Porter had some trouble with the Governor, because the latter's wife complained that he did not cultivate enough vegetables for her table, this being the only use conceivable by His Excellency of Botanic Gardens.

With the retirement and death of Sir Stamford Raffles progress in agriculture commenced to dwindle, and though Dr. Oxley and a few other Europeans took a certain amount of interest in the subject, little advance was made in cultivation for many years. Planting certainly increased in some directions under the hands of the Chinese, and also under Europeans; nutmegs, cloves, cocoanuts, sugar, gambir and pepper were grown to a considerable extent, but only empirically and without the aid of any scientific botanist. The result of this method was

shown in the sudden collapse of the nutmeg plantations in 1860, entailing enormous losses of capital and general despondency. Later again came the devastation of the Cocoanut estates by the two cocoanut beetles,* added to which came considerable losses of money due to various speculations of amateur planters, one of which is mentioned by Murton in his first Annual Report.

An Agricultural and Horticultural Society was founded about 1837 in Singapore, when Dr. Montgomerie was President, and Dr. Oxley took a leading part in it. Papers were read on Cotton planting and other subjects, and it is said all the European gentlemen then in Singapore belonged to it. It seems to have died a natural death about 1846, about which time a similar society was founded in Penang under the name of the Agricultural Planters Association.

In 1859, another Agri-Horticultural Society was founded in Singapore. This was chiefly really a Horticultural Society, and commenced the laying out of a portion of what are now the present Botanic Gardens. The gardens were supported by public subscription, aided by Fancy Bazars and Exhibitions, but, as has often happened in similar societies, the subscriptions at last proved insufficient, and in 1874 the Gardens were taken over by the Government. In 1874, Mr. James Collins was appointed Economic Botanist and also took charge of the Raffles Museum. He is chiefly known for his work on Rubber, published in 1879-1891, and he also started the "Journal of East Asia," of which, however, only a single number was published. He made a collection of gums, resins and other vegetable products, which is now in the Botanic Gardens Museum. He left in 1875.

In 1875, Mr. A. J. Murton was appointed Superintendent of the Botanic Gardens, and shortly afterwards Mr. Walter Fox, his Assistant. Mr. Murton remained in charge till 1879. He introduced a large number of useful as well as ornamental plants into cultivation, including Para Rubber, Castilloa, Cera Rubber, Liberian Coffee, Ipecacuanha, and very many other plants. He also studied the local flora, especially giving his attention to

* *Oryctes rhinoceros* and *Rhynchophorus ferrugineus*.—HON. ED.

Gutta-Percha and the wild rubber vines *Willoughbeia*, and made botanical excursions into Perak and Kedah, during one of which he planted the first Para Rubber trees in Perak in Sir Hugh (then Mr.) Low's garden at Kuala Kangsa and at Teluk Anson.

In 1880, Mr. Murton was succeeded by Mr. N. Cantley, who continued the excellent work begun by Mr. Murton, and in 1884 managed to add to the gardens a large piece of land known as the Military Reserve, which was forthwith converted into the Economic Gardens. This land, covered to a large extent with scrub, and some Chinese vegetable and indigo gardens, was a valuable acquisition as the original Botanic Gardens were far too small for the propagation of the useful plants required for the Colony and the Native States which were now beginning to develop.

Although the funds available for opening up this part of the garden were not large, good progress was made. Numbers of new and useful plants were introduced and those previously introduced were extensively propagated and dispersed to various parts of the Peninsula and elsewhere. Mr. Cantley published also a list and account of the Economic plants under cultivation in the gardens ; a good deal of his time also was taken up in framing the Forest Department and experimental planting of timber trees. Mr. Cantley died in Tasmania in 1887, and was succeeded in 1888 by the present Director (Mr. H. N. Ridley).

During Mr. Cantley's superintendence, the present Botanic Gardens of Penang were founded and put under the charge of Mr. C. Curtis in 1884. These gardens were not only ornamental but supplied a considerable number of useful plants to planters in other parts of Penang, and Mr. Curtis made also many important contributions to our knowledge of the cultivation of rubber, gutta-percha, sugar, and other useful plants. He retired in 1903.

The small gardens of Malacca at Bukit Sebukor were founded in 1886, on ground presented by a Chinaman, on condition that it should be converted into a garden, and should revert to him if the garden was given up, which happened in 1894, when the Government abolished the garden. The Malacca Garden was under the

superintendence of Mr. Robert Derry. The use of this garden was simply to supply local requirements in shade and fruit trees and other useful plants necessary for the inhabitants of Malacca, which work it did very well, but besides this experiments were carried out by the Superintendent on castor oil, fibre plants, *Mauritius* hemp, pineapple, etc., and other useful plants, and the first para-rubber trees in Malacca were planted in this garden. Some time after the abolition of this garden, a small garden was made at the water works at Ayer Keroh, where a number of useful plants were cultivated, and near the same place plantations of para rubber and gutta-percha were planted. It is interesting to note that the first practical rubber estate started in the Malay Peninsula was made by Mr. Tan Chay Yan, at Bukit Lintang, in Malacca, in 1896. This planter later opened an estate at Bukit Asahan which is probably the biggest estate in the Peninsula.

Agriculture in the Native States received its first impetus under Sir Hugh Low, in Perak, in 1876. Teak was planted on road sides, coffee cultivated on the Hermitage and other hills, and cinchona also tried, as well as tea, some cocoa and pepper.

At Kuala Kangsar, many of the best indigenous fruits were cultivated, para-rubber introduced, and one or two plants of *Ficus elastica* grown as terrestrial plants instead of epiphytes as usually seen.

In some of the gardens, tea, coffee, pepper and some fruits were cultivated on a sufficiently large scale to test their marketable value, but with Sir Hugh Low's departure nearly all were leased and soon collapsed. The Kuala Kangsar Garden became the dépôt of exchange for all the different districts of Perak, all of which were well provided with fruit trees and other economics, and this garden has been regularly maintained as the principal Perak Garden. The last garden started by Sir Hugh Low is on the Taiping Hills, where the tree Tomato and English vegetables are successfully grown.

SHEPHERD'S PATENT WOOD REFUSE FURNACE.—The Timber Trades Journal has the following note upon this furnace:—Mr. A. Shepherd, of A. Shepherd & Co., Ltd., of Grimsby, has

forwarded to us circulars containing testimonials recently received by him in praise of his patent wood refuse furnace. These include letters from English Bros. Ltd., Burt, Boulton & Haywood, Ltd., Victoria Docks, London, Nicholson & Sons, of Leeds, and P. H. Haydock, of Chorley. We have on many occasions referred to Mr. Shepherd's furnace, which is a great saver of labour, an economiser, utilising sawdust as a fuel by itself. Of course it can be converted into a destructor in cases where the supply of refuse exceeds the demands for purely steam-producing purposes. It can be adapted to any kind of boiler, and it is strong and simple in construction, there being nothing mechanical to get out of order.

FOREST FIRES IN FRANCE.—A Reuter's telegram from Toulon recently stated that a great forest fire had been raging in the cork forests of St. Nicholas de Gratteloup and the Dom de Borne. A telegram received the next night stated that the conflagration then extended over five square miles of forest land. The greatest consternation prevailed among the inhabitants, who had reckoned upon a good yield from the cork trees.

WIRE DOORS AND WINDOW SCREENS.—The Canadian Commercial Agent at Cape Town (Mr. C. M. Kittson) reports that South Africa, owing to the fact that she has at certain seasons many insect pests, offers a peculiarly suitable market for the exploitation of wire window screens (adjustable variety), and wire screen doors. Neither of these articles, he adds, have, up to the present, received the attention which the possibilities of the market deserve.

South Africa is not the only country which does not appear to have given sufficient attention to these most useful aids in keeping out the swarms of flies and other insects which are such a curse during certain portions of the year in India. This remarkable indifference to such conveniences is little short of wonderful. Outside Baluchistan, where the doors and windows in the houses are provided with wire screens, and a few places round Lahore, we know of few bungalows, and we speak more especially of dák and district bungalows and rest houses, which can boast of these luxuries

though they should almost be deemed necessities. How much more inhabitable for instance would be the dâk bungalows on the road to Baghi out beyond Simla (a trip which most inhabitants of Simla take at times) were they fitted with screens to keep off the one curse to a paradise—the flies. We would draw the attention of the Public Works Department to both these articles.

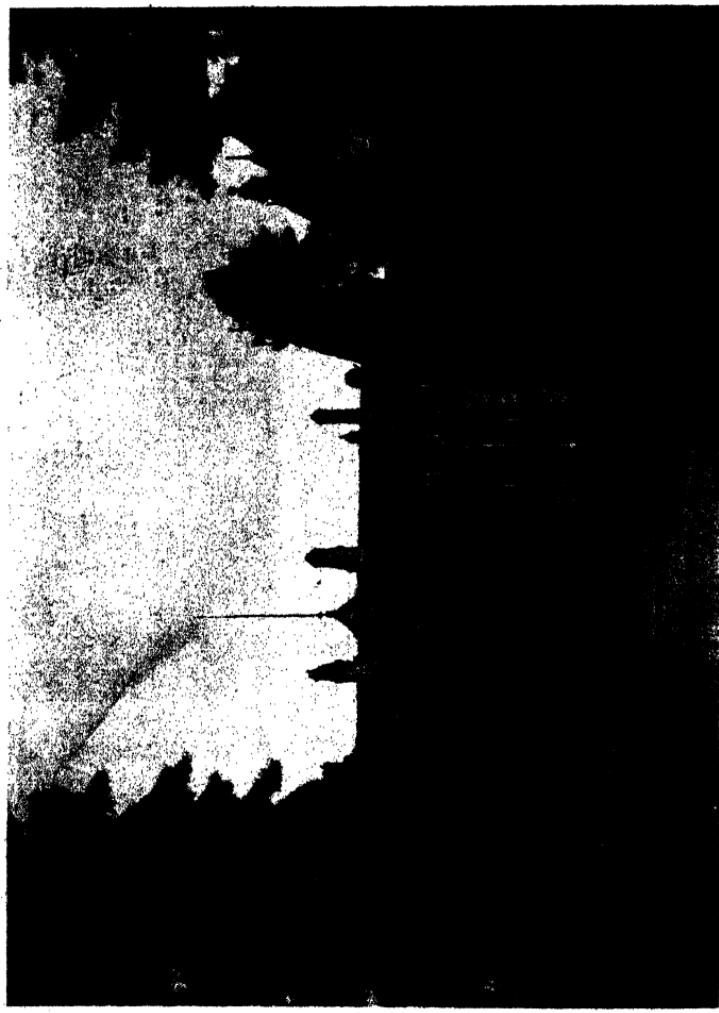
COLONIAL FRUIT SHOW IN LONDON.—The Royal Horticultural Society of London have decided to hold a show of Colonial grown fruit on December 5th and 6th, 1905, to be followed by others in March, May and December 1906.

In reference to this it may be interesting to some of our readers to note the following extract from a letter received by the Imperial Commissioner of Agriculture from the Secretary of the Royal Horticultural Society, published in the *Agricultural News*, Vol. IV, No. 87 :—

“Your growers should fully understand that they can get awards for a case of a single fruit, a collection of marketable preserves, just as well as for a collection of many kinds of fruits, provided there is excellence of quality and that there is no actual competition between the several exhibits.”

Would not this be a good opportunity for Quetta and Baluchistan generally to show what the Province can do in the production of magnificent fruit?

INCIDENT OF A FOREST FIRE IN HUNGARY.—A serious accident occurred in the State woods in the neighbourhood of the Hungarian town of Herkulesbad, where 800 soldiers were engaged in putting out a forest fire which had been smouldering for some weeks. During the operations two soldiers were killed and three severely and eleven slightly injured by falling rocks.



R. I. E. College, Cooper's Hill—Front View.

INDIAN FORESTER

DECEMBER, 1905.

FORESTRY IN CANADA.

Among the British Dependencies which are now paying serious attention to the future adequate protection of their forests Canada may be said to take a foremost rank. For many years the destruction of the vast forests existing in the Colony had been carried on unchecked, and this reckless over-cutting has within the last few years attracted the attention of all thoughtful statesmen and others interested in the future well-being of the Dominion. It became increasingly obvious that if some steps were not taken to put a stop to the existing state of affairs irreparable damage would result, both climatically and financially, to the country. Opinions were also freely stated in the home markets that it would be but a matter of a few years for the supply of Canadian-grown timber to give out, even in spite of the fact that it is said that 75% of the Dominion is under forest. This being the state of affairs, the forestry movement will be welcomed alike by statesman, financier and merchant.

Some five years ago an Association termed the Canadian Forestry Association was formed. One of its chief objects was "to consider and recommend the exploration, as far as practicable, of our public domain and its division into agricultural, timber, and mineral lands, with a view of directing immigration and the pursuits of our pioneers into channels best suited to advance their interests and the public welfare. With this accomplished, a portion of the unappropriated lands of the country could be permanently reserved for the growth of timber."

Although enormous wheat tracts exist in the western portion of the Dominion and large settlements in the older provinces, Canada still possesses the greatest wooded area of any country

in the world, and with proper and efficient management these forests should form one of the world's chief wood supplies for an indefinite period. It is in the world's interest that this should remain so; but the position will only be maintained by the introduction of a strict forest conservancy on up-to-date lines. Mr. R. C. Milward in his articles on "The Long Round to England" * has shown that, as is the case in America, the lumbering interests form a powerful and important faction in the State. The American Forest Congress of last January † conclusively proved, however, that the lumbering interests, so far from being opposed to the introduction of a proper forest conservancy, were all strongly in favour of it.

The Forest Association has been working, much upon the same lines as the Americans, with a view to reconciling apparently conflicting interests and, almost more important still, to awakening enthusiasm in the matter amongst the leading officials of the Dominion Government and the people at large. The results of the Annual Meetings were fully published in illustrated Annual Reports, of which the fifth is before us at present. The Meeting which this latter details was of considerable interest, since it took the first steps towards a departure of considerable magnitude and importance. The necessity of starting a quarterly periodical of forestry was discussed, referred to a committee, and subsequently agreed upon, with the result that the present year has seen the appearance of the *Canadian Forestry Journal*, the first number of which has been reviewed in these pages.‡ This in itself has already undoubtedly exerted a considerable influence on all sections of the people of the country.

From communications recently received from the Secretary we are in a position to state that a further important movement has been initiated, the Premier of the Dominion, Sir Wilfrid Laurier, having issued an official summons calling together a Canadian Forestry Convention to meet on the 10th, 11th, and 12th January 1906.

* 'Indian Forester,' Vol. XXX, 323 (1904).

† 'Indian Forester,' XXXI, 186.

‡ *Vide p. 456.*

The call is addressed to the "Public of the Dominion of Canada," and is issued in these words:—Canada possesses one of the largest areas of virgin forest of any country in the world and is ranked by European experts first, or among the first, of the important sources of the world's timber supply for the future.

The preservation of the streams in perennial and constant flow, which is largely controlled by the forests on the watersheds, will have an important influence on the industrial development of the Dominion. The expansion of our electrical and mechanical industries will be regulated to a great extent by water, which forms the greatest source of power in all countries, and some of our western districts are dependent on irrigation to ensure the success of agricultural operations.

In all the older provinces the clearing of the soil has been carried to such an extent that the ill effects on the water supply and on agriculture are clearly marked, while on the western prairies the need of sheltering trees for houses and fields is seriously felt by the settlers.

The early construction of the Transcontinental Railway and of other railways through our northern forested districts, and the consequent opening of those districts to general traffic, will increase the danger from fire, which has already been a most active agent of destruction.

These conditions are not new: they have from time to time received public attention, and during the Session just closed Parliament authorised the summoning of a Convention for the more thorough discussion of the same.

I therefore hereby call a Public Convention to meet in the City of Ottawa on the 10th, 11th, and 12th of January 1906, under the auspices of the Canadian Forestry Association; and to this Convention are specially invited Members of the Senate and House of Commons, Lieutenant-Governors of the Provinces, Members of Legislative Councils and Legislative Assemblies of the Provinces, Dominion and Provincial Forest Officials, Members of the Canadian Forestry Association, Representatives of Lumbermen $\frac{1}{2}$ Association, Representatives of Boards of Trade,

Representatives of Universities, Representatives of Agricultural Colleges, Representatives of Farmers' Institutes, Representatives of Railway Companies, Representatives of the Canadian Mining Institute, Representatives of the Canadian Society of Civil Engineers, Representatives of Associations of Land Surveyors, Representatives of Fish and Game Associations,—and all others who take an interest in Forestry.

An invitation is also extended to the Bureau of Forestry of the United States, the American Forestry Association, and the State Forestry Bureaus and Associations to send representatives to this Convention.

The proceedings of the Convention will be watched with considerable interest throughout the Empire, since they will doubtless lead to results fraught with the weightiest consequences to Canada herself, to the Empire, and to the world at large. We ourselves, whilst congratulating the Dominion on their latest and greatest step taken in the interests of their valuable forests, shall hope to see as a result the seed sown of a healthy, useful, and flourishing Forest Service which will prove in the future one of the pillars of the State.

SCIENTIFIC PAPERS.

SOME INDIAN FOREST FUNGI.

BY E. J. BUTLER, M. B., F. L. S.

CRYPTOGAMIC BOTANIST TO THE GOVERNMENT OF INDIA.

PART IV.

THE BARBERRY RUSTS

The classical example and the first known of the power of changing hosts (heterocism) in the rust fungi is that of the black rust of cereals, *Puccinia graminis*. About 90 years ago a Danish schoolmaster named Scholer discovered that the dust in the cluster cups (*Aecidia*) of the common barberry was able to induce *Puccinia graminis* when shaken on rye. From that

small beginning the study of the cereal rusts, those most destructive of all known fungus diseases, has been built up. Of late years the opinion has grown with many observers that the stage of the disease passed on the barberry may be dispensed with, and that the uredo and teleuto stages may appear year after year on corn without any intervening aecidial stage.

In India it is certain that this is the case. The last few years' observations have shown that *Puccinia graminis* is one of the commonest rusts in the central areas of India. The barberry, on the other hand, is confined to the higher mountains—the Himalaya and one or two other high ranges or peaks. Last year (1904) *Puccinia graminis* was found in every wheat field in places over 600 miles from the nearest barberry, a distance through which it is absurd to suppose that aecidiospores could be carried by the wind in any quantity. It is almost equally certain that no other plant occurs in these areas which replaces the barberry as a host of the *Aecidium*. The statement often repeated that the cereal rusts are largely caused by the leaf fungi of the Himalayan forests is therefore devoid of foundation.

Even the study of the barberry *Aecidia* themselves shows how little they can be called into question in this connection. For the true *Aecidium Berberidis* of the cereal black rust is a species whose range in the Himalaya is restricted. So far as present investigations tell it does not appear east of Simla. Around Simla it undoubtedly occurs on *Berberis Lycium*, and probably also on *B. coriaria* Royle, *B. aristata* D. C., and a species which has been doubtfully referred to *B. umbellata* Walt. It probably also occurs on *B. vulgaris* to the west of Simla, where alone this species is found.

The odd thing about this is that it is precisely at the only part of the Himalayan range where *Aecidium Berberidis* is known to occur that black rust is extremely rare on cereals. In many years' search Barclay only once found it on wheat near Simla. It is, however, common on a wild grass, and with sporidia from this Barclay succeeded in producing the *Aecidium* on *B. Lycium*. The only conclusion to be drawn is that the form found

on the wild grass is a specialised form, which neither in its uredo nor in its aecidial stage can pass to the cereals. Hence even where

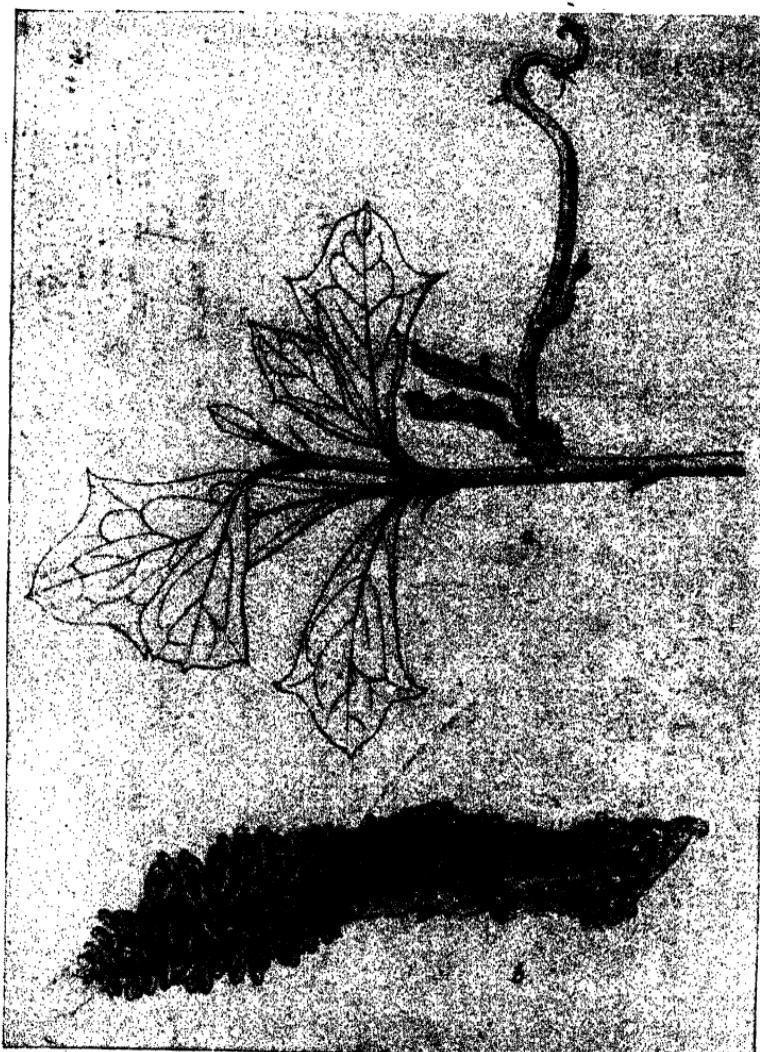


FIG. 11.—*ECIDIUM MONTANUM* ON *BERRERIS LYCIUM*. *a* DEFORMED SHOOT TURNED VERTICALLY UPWARDS (NAT. SIZE); *b* A LEAF BEARING AECIDIA (MAG. 4 TIMES).

the *Æcidium* is found its influence on the rusting of cereals is slight. A number of similar cases of this specialisation or splitting up of a parasite into races each confined to one variety of host are now known.

East of Simla *Æcidium Berberidis* is replaced by a second species of much interest. I have received it from several Forest officers from Jaunsar on *B. coriaria*, *B. aristata*, and *B. Lycium*, and it is abundant around Mussoorie. It is at once distinguished from the other by the peculiar deformity of the affected branches. A witch's-broom formation is induced on attacked parts, sometimes involving as much as half the bush. All the new shoots show negative geotropism or a tendency to grow vertically upwards. The *Æcidia* are found on small deformed leaves surrounding the buds or on specially modified shoots arising from the latter. These shoots are soft, blackish and curiously twisted in many cases and bear only spines or small, often deformed, leaves. The *æcidial* cups are formed on the under surface only of the leaves, but are scattered irregularly on the shoots. The floral peduncles are sometimes attacked and also some nearly normal shoots, which are, however, blackened over the area which bears the parasite. All the deformed parts contain a perennial mycelium in the interior of the tissues from the influence, of which no doubt the new growth shows its peculiar characters.

A second form, confined to the leaves, is also found, and from its characters seems to arise from infection anew by spores, and not from the perennial mycelium. Fully developed normal leaves are attached, the fungus producing large reddish or bright scarlet patches on the upper surface, and numerous very long tubular *Æcidia* below. Little deformity results, at the most a puckering of the leaves.

Intermediate forms between the two extremes described are frequent. Sometimes from a rosette of the stunted deformed leaves of the first variety a few normal leaves may arise, some of which have large patches of the second kind of attack. The appearance strongly suggests a secondary infection of normally developed leaves either by the *æcidiospores* themselves or by

sporidia from another host bearing the teleutospores. A second host is, however, unknown.



FIG. 12.—*AECIDIUM MONTANUM* ON A NORMAL LEAF OF *BERBERIS LYCIUM* (ENLARGED).

The first form is found from May until the old weather, and perhaps continues during the latter, while the form on normal

leaves appears in June and July. Experiments have shown that neither form can infect cereals.

The influence of the parasite on the host may be summarised as follows : Dwarf shoots are produced at the nodes of a branch either as a result of infection from a perennial mycelium below or from new infection of the undeveloped bud by spores. These are formed during a considerable part of the year. Small deformed leaves arise on them, the internodes being much shortened, while the axis is thickened. As a result a cylindrical formation about half an inch in length, densely crowded with scales and minute fungus-bearing leaves, is produced. The leaves then fall, leaving the persistent scales while new buds may be formed in the axils of the fallen leaves. At the same time the peculiar succulent *Aecidia*-bearing shoots referred to above arise either in prolongation of the main axis of the dwarf shoot or from a lateral bud. Sometimes the whole of this, which may be 6 or 8 inches in length, is a spore-bearing organ, sometimes a part only ; it is not uncommon also to find that the lower part alone bears the fungus while the upper has grown on into a harder thorny shoot approaching the character of a normal one. Leaves may be formed on this prolongation, but they are usually small, while the part which bears *Aecidia* is as a rule devoid of leaves or, if provided with any, they are deformed *Aecidia*-bearing ones. The portion of the shoot on which the fungus is found fructifying is always more or less blackened and rounded, usually hypertrophied, while the normal shoots are covered with a greyish bark and are angular. Normally developed leaves can also be attacked and produce large *Aecidial* patches unattended by deformity. Sometimes bushes are found with only this leaf form unaccompanied by any witch's-brooms.

In a section of one of the modified shoots bearing the *Aecidia* the perennial mycelium may be very easily detected. All the tissues are affected, with the possible exception of the cambium. The hyphae run in the walls and intercellular spaces. Their contents frequently show yellow oil-drops. Haustoria for food aquirement are simple or branched finger-like processes, which

appear to be sometimes covered with a protrusion of the cell-wall such as is found in the haustoria of the Erysipheæ. Hypertrophy is slight and is chiefly found in the dwarf shoots which arise from infected buds and grow as short thick axes crowded with minute leaves.

Three fungi are known on species of barberry in other countries resembling this. One, *Aecidium Magellanicum* Berk., was found on *B. ilicifolia* in Terra del Fuego. Its *Aecidia* are found often on the petioles. Another, *Aecidium graveolens* ShuttJew., is connected with a *Puccinia* on *Arrhenatherum* in Europe and produces a complex and constantly increasing deformity while the *Aecidia* are sometimes found on the upper surfaces of the leaves. The third is *Aecidium Jacobsthali* Henrici Magnus, which appears to have no spermagonia and to produce considerable thickening of the branches. Its acelial cups are also short. The Himalayan species cannot be identified with any of these, and I have called it *Aecidium montanum*. Its diagnosis is as follows :—

Aecidium montanum Butl. n. sp. Maculæ absent or brilliant crimson with a black centre on the upper surface of the leaf and pale red below; spermagonia scattered on deformed shoots and leaves, or crowded in the black centre of the maculæ, chiefly epiphyllous but also hypophyllous in a group in the centre of the *aecidia*, black, sunken, flask-shaped, broader than deep, 65 micro-millimeters deep below the epidermis, 120 m. mm. broad, paraphyses 3 m. mm. broad, projecting in a stiff bundle from the mouth to 50—75 m. mm. above the surface; spermatia minute, set free with mucus; *aecidia* numerous and crowded on the whole of the under surface of the leaves or on patches $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter; pseudoperidium elongated to 4 mm. on the underformed leaves, rarely more than 2 mm. on the witch's-brooms, orange below, whitish above; *aecidiospores* orange, irregularly globose, ovoid or angular, 17-35 \times 17-29 (average 19 \times 23) m. mm. in diameter, episporae finely wrinkled.

On *Berberis Lycium* Royle, *B. coriaria* Royle, and *B. aristata* D.C. in the N.-W. Himalaya.

PUCCINIA DROOGENSIS N. SP.

In the Niligri Hills *Berberis aristata* was much rusted in 1904. The rust, however, differed from those described above, for, while the uredo and teleuto forms were abundant on the leaves, I could not find any *Aecidium Berberidis*. Even if *Aecidium Berberidis* should occur on these hills it can be of but little economic importance, for wheat cultivation is not common in South India.

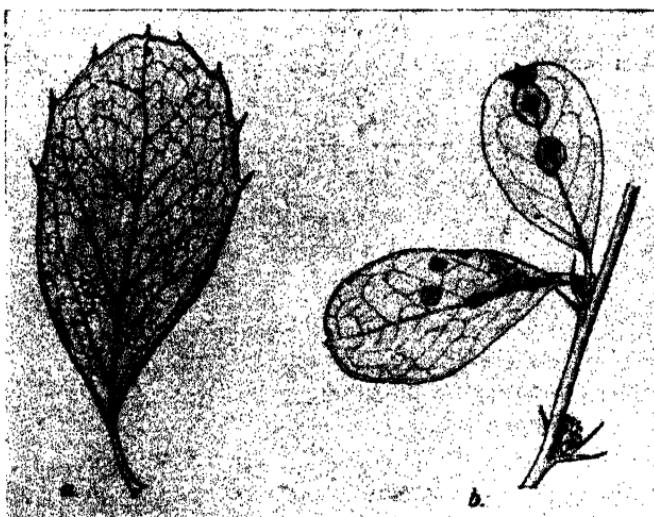


FIG. 13.—*PUCCINIA DROOGENSIS* ON *BERBERIS ARISTATA*.
a UREDO STAGE; b TELEUTO STAGE.

The species does not agree with any already described, and I have named it *Puccinia droogensis*. Its diagnosis is as follows:—

Puccinia droogensis n. sp. Uredosori amphigenous, sparse, small, long covered with the epidermis, yellow, in irregular maculae pale with a red centre on the upper surface of the leaves; uredospores long-elliptical or clubshaped, yellow, 15-21 × 27-42 m. mm. in diameter, episore up to 3 m. mm. thick with regular scattered spines; teleutosori on purple maculae, amphigenous, pulvinate, confluent, irregular, $\frac{1}{4}$ to 1 m. mm. in diameter; teleutospores elliptical, both ends rounded, constricted at the septum,

brown, 30-45 x 18-24 m. mm. in diameter, episporae very thick and marked with tubercles arranged in series.

On *Berberis aristata* D. C. in the Droog, Nilgiri Hills, altitude 6,000 ft., October 1904.

GAMBLEOLA CORNUTA MASSEE.

Berberis or *Mahonia nepalensis* bears a remarkable rust in the Mussoorie and Jaunsar Himalayas. This is the species from which Mr. Massee of Kew derived the new genus Gambleola, named in honour of its discoverer, Mr. J. S. Gamble, F. R. S., of the Indian Forest Service. The species is known as Gambleola

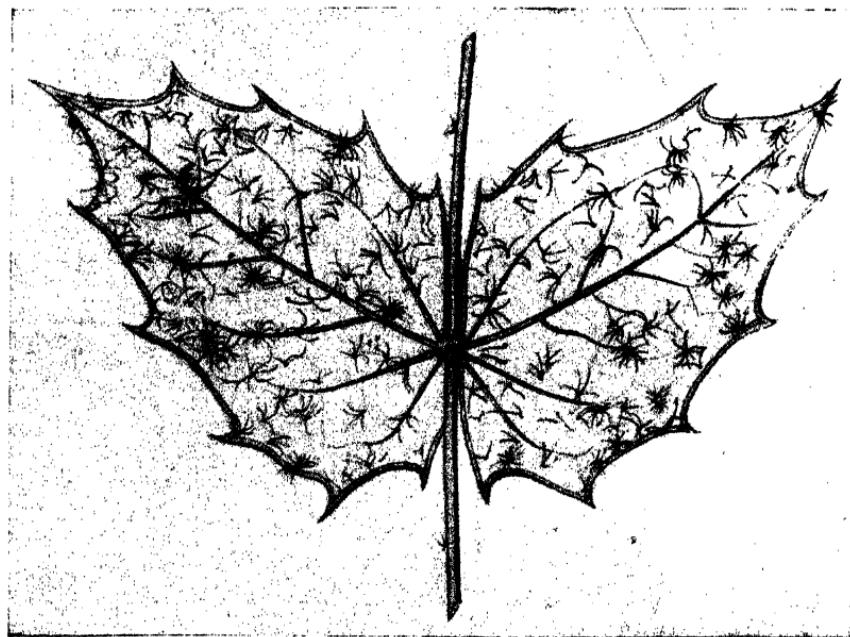
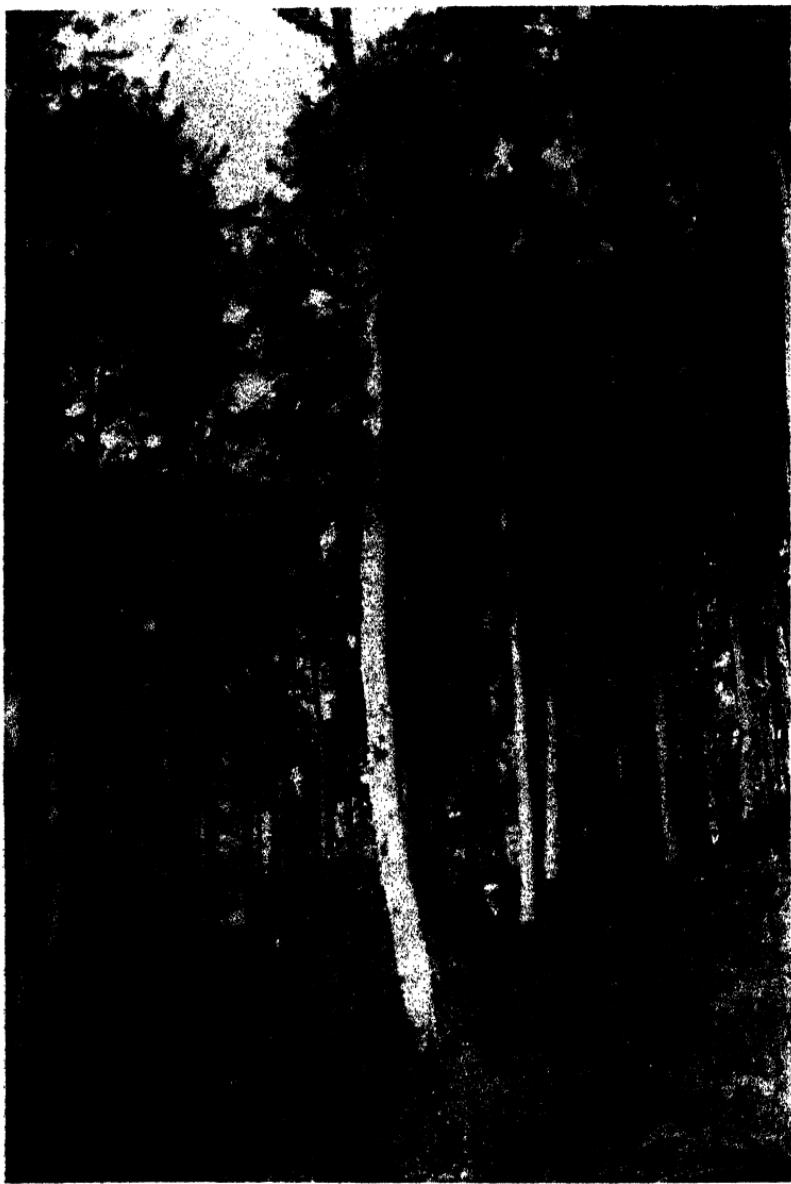


FIG. 14.—GAMBLEOLA CORNUTA ON BERBERIS NEPALENSIS.

cornuta. It appears in the form of long black wavy hairs grouped in clusters on the under surface of the leaves and sometimes also on the twigs. Each hair consists of many chains of two-celled teleutospores adhering closely to one another in the chain and



Forêt de Retz (Beech), France, visited by the Cooper's Hill Forest Students.

also to adjoining chains. No other spore form is known, and it would be a matter of extreme interest to follow out its development and ascertain its life-history. This must be left to those fortunate enough to live near the haunts of *Berberis nepalensis*; but there are few pursuits of more absorbing interest than to trace in such fungi as this the varied changes of form, associated as they so often are with an alternation of hosts.

ORIGINAL ARTICLES.

THE FORESTRY BRANCH AT COOPERS HILL.

BY W. R. FISHER, B. A.

Coopers Hill is an ideal place for a Forest School. With 100 acres of land, about 25 of which are woods, with splendid playing-grounds, easy access to the river Thames, a good rifle-range and gymnasium, and excellent buildings for class-rooms, laboratories and the accommodation of students, a finer institution for the mental and physical training of young men could not have been established. Situated high up above the Thames valley and its fogs, on the plateau of the Bagshot sands, in the immediate vicinity of Windsor Park, with 4,000 acres of bracken and heather containing groups of magnificent forest trees, and with a real bit of old English native woodland in the birch and oak of Englefield Green, the students in their first tour soon learned to distinguish between the different species of trees and shrubs. The woods of Windsor Forest, 10,000 acres in extent, with extensive crops of Scots Pine in all stages of existence, and with 1,200 acres of oak wood about eighty-five years old, from which a working-section of oak forest might easily be formed, afford an excellent training ground for the more advanced student. There are about 50,000 acres of beech-wood managed under the selection system, with natural regeneration, in the Chiltern Hills, within a day's drive, while an excellent crown coppice-with-standards, at Orshott, is within 14 miles of the College and contains an area of over 800 acres.

From 1890 to 1900 the College leased about 800 acres of pine wood and heather waste from the crown near Cæsar's Camp, where the students learned to plant and to thin the woods, and protect them from the dangerous heath fires. Here, also, they formerly prepared forest working plans, which work is now done in Germany. Since 1900, after all the waste land in Cæsar's Camp, 400 acres, had been planted and its management resumed by the Crown, Mr. F. Simmonds, the Deputy Surveyor of the Forest, has kindly given the students every possible facility for working, as before, in different parts of the forest. The Thames river-beds afforded another practice ground, and so did the excellent nursery at the College started by Dr. Schlich in 1885. Here the students sowed and planted and studied nursery-management, the nursery supplying 60,000 four-year-old pine plants annually during our tenure of Cæsar's Camp, which were planted out there; while since 1900 the plants, always exceptionally good ones, have been sold and planted in various woodlands all over England.*

In 1891 Dr. Schlich planted in the College grounds, on a sloping sandy loam, with a northerly aspect, some model plantations, which are now 14 years old: being the only ones of the kind in Britain, they have been visited by numerous foresters. Pure Silver-fir, spruce, Douglas-fir, Scots and Weymouth pine, and larch, also pure beech, hornbeam, alder, birch and oak, and mixtures respectively of larch, oak and Scots pine in the beech and Silver-fir, constitute the chief crops. There are also instructive mixtures of ash and oak, the oak being all killed out, and of ash and alder in which the alder is rapidly killing the ash. These show the effects of fast-growing species on slower-growing light demanders.

The crops are each one quarter of an acre in extent, or somewhat less, but they are large enough to show the effects of light and shade and close and open growth on young trees, and afford

* Some hundreds bought by myself when on leave in 1897 and planted near Crowborough in North Sussex have made the most wonderfully rapid growth.—*HON. ED.*



excellent examples of the comparative rapidity of growth of species during youth. In the larch and beech woods, the larch poles, now 17 years from seed, are 40 feet high and over two feet in girth at the base, while the girth of the pure larch averages nine inches less, although the poles are still 40 feet high. These pure larch crops have now been under-planted with silver-fir and beech. The immunity of the larch from disease is complete in these plantations, although there are crops of larch ruined by the larch fungus (*Dasyphypha*) within two miles.

The long afternoon autumn and spring rambles in the various woodlands I have here described, where the students have done their full share of practical forest work, have afforded the best possible means for sylvicultural instruction ; while during summer, whole days have been spent in the more distant woods. It is sad to think that we cannot transfer our nursery and the model crops of trees to Oxford, with our Museum and Library ; but there we hope, through the liberality of St. John's College, to start similar plots in the Bagley wood of 650 acres.

Dr. Schlich, then Inspector-General of Forests in India, started the Forest training at Coopers Hill in October 1905. He was at first the only Professor of Forestry, while Mr. H. Marshall Ward was Professor of Botany. The students were admitted to the College after passing a competitive examination in the following subjects :—

1. Handwriting, Orthography, and English Composition.
2. Elementary Mathematics.
3. Mechanics, Physics, Botany, Mineralogy, and Geology.
4. Inorganic Chemistry.
5. Geometrical and Freehand Drawing.
6. French or German.

It will be noticed that the subjects were essentially scientific, and, as long as this system of examination prevailed, the Forest students constantly obtained prizes at the College for Science, prizes which were also open to the Engineering students.

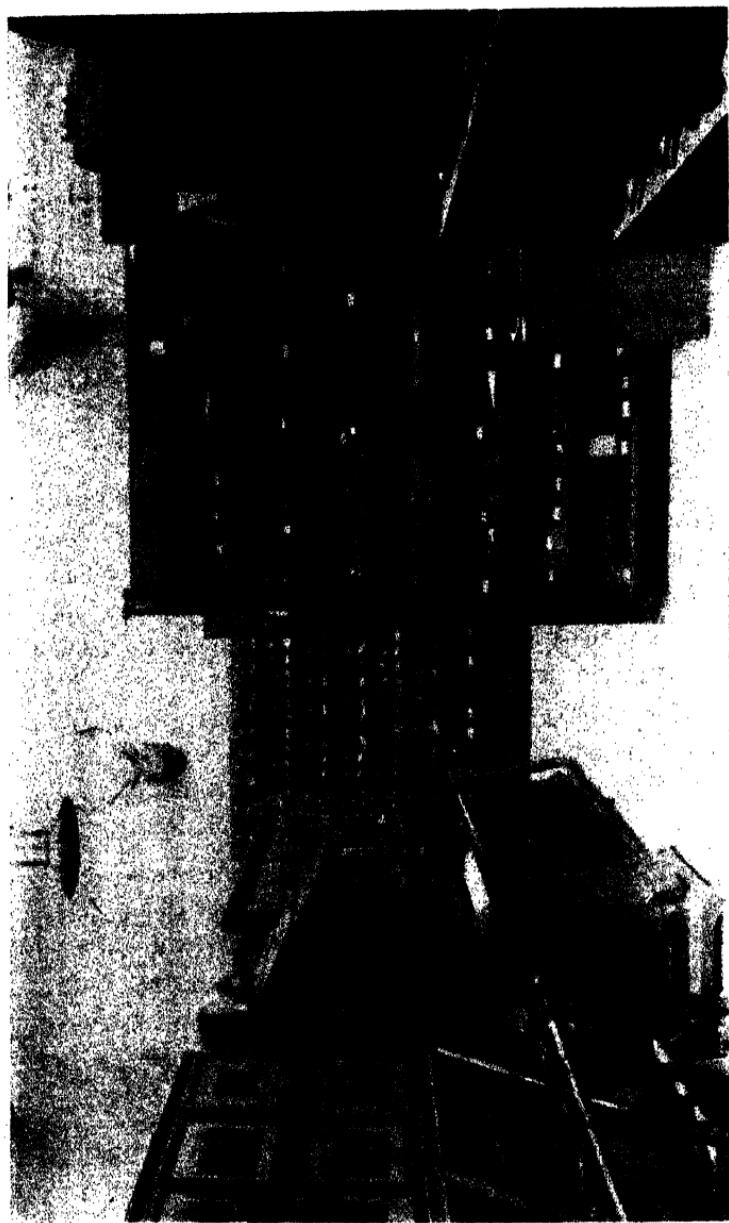
The Forest students remained at the College for two years, under the same general regulations as those applicable to Engineers, and their work in Physics, Geology, Inorganic Chemistry, Surveying and Geometrical Drawing and, to some extent, in Mathematics, was the same as that done by the latter. A special course of Forest Engineering was given to our students. At the end of the second year, the students spent about three months in studying in detail certain forest districts in Great Britain and Germany, this being in addition to occasional excursions to woodlands made during their stay at Coopers Hill. Mr. A. Shipley, Fellow of Christ College, Cambridge, was, in 1887, appointed Lecturer in Entomology to the Forest Branch.

In 1888 Sir Dietrich Brandis, K. C. I. E., F. R. S., was appointed Director of the Practical Study of Forestry, and conducted the tour in Germany. Professor A. H. Church, F. R. S., was also appointed Instructor in the Chemistry of Soils and Vegetation, and gave a special course of lectures to the Forest students.

The first batch of Assistant Conservators of Forests, Messrs. Rogers, Hart, Hill, and E. G. Oliver, who had been trained at Coopers Hill, went out to India in 1887.

Mr. W. F. H. Blandford succeeded Mr. Shipley as Lecturer in Entomology in 1889. In 1890 Mr. W. R. Fisher, Conservator of Forests in India, was appointed Assistant Professor of Forestry, and in 1891 the first-year students at the end of their first year's course went for a fortnight's tour in the French broad-leaved forests in Normandy, this tour having been continued ever since; in 1900, however, the forests at Compiègne, Villers Cottorêts, and Valenciennes were substituted for the Normandy forests, and the Forest at Le Quesnay added in 1905. Detailed work in marking trees for felling and thinning, under the compartment system, with natural regeneration, was then done by the students, while they also visited two pine woods under coppice-with-standards.

In 1890 the course of study was raised from 24 to 34 months, divided into nine terms. During the first eight terms the students studied at the College and the remaining term was spent in



Germany. It was then also laid down that, with the special permission of the President, students not nominated by the Secretary of State for India for the Indian Forest Service might be received at Coopers Hill, either to follow the whole Forestry course or to participate in the instruction given in certain subjects only. The only students who have benefited by this provision are five from Cape Colony, one from Mauritius, four from Native Indian States, one from Ceylon, one from Siam, and two from the Malay States. This regulation provided for both resident and non-resident students, but its provisions were not generally known, so that very few presented themselves for the course, and in two cases its benefits were disallowed by the President, so that we have only had two non-resident Forest students.

Mr. B. H. Baden-Powell, C.I.E., late of the Indian Civil Service, was appointed Lecturer in Forest Law in 1891, the subject of his lectures forming his well-known "Manual of Indian Forest Law." In June 1891 a change was made in the entrance examination for Forest candidates, which was in future to follow the lines of the examination for Woolwich.

The reasons for this change were to discourage cramming a number of subjects and to enable the Public Schools to send candidates direct for the Public Service, but, as many of the students took up no science except Elementary Mathematics, classical men with no knowledge of science frequently passed into Coopers Hill. One of these gentlemen, who sank from first to last in the list, left the College at the end of his first term, and subsequently competed successfully for the Indian Civil Service. Coopers Hill training required men with a decided bent for science, and when the Indian Police Service was recruited by the same examination, as well as Woolwich, our students were frequently beaten by men who were attracted to the other Services.

In 1895 Mr. Baden-Powell resigned his appointment at the College, instruction in Forest Law being given by Mr. Fisher. In 1896 Dr. Marshall Ward became Professor of Botany at Cambridge.

In 1897 Mr. C. A. Barber was appointed Professor of Botany, and also succeeded Mr. Blandford as Instructor in Entomology.

In 1895 Sir Dietrich Brandis resigned the post of Director of the Practical Study of Forestry on the Continent, and Dr. Schlich undertook this work, in addition to his other duties. At the same time, the course of study at Coopers Hill was modified, the students were to remain for seven terms at the College, and to study for five or six months in Germany, being sent generally in pairs to selected forest divisions in Prussia, to work under the local Forest Officers. They finished their work on the Continent with a general tour of six weeks under Dr. Schlich, during which certain interesting forests in South Germany and in Switzerland were visited.

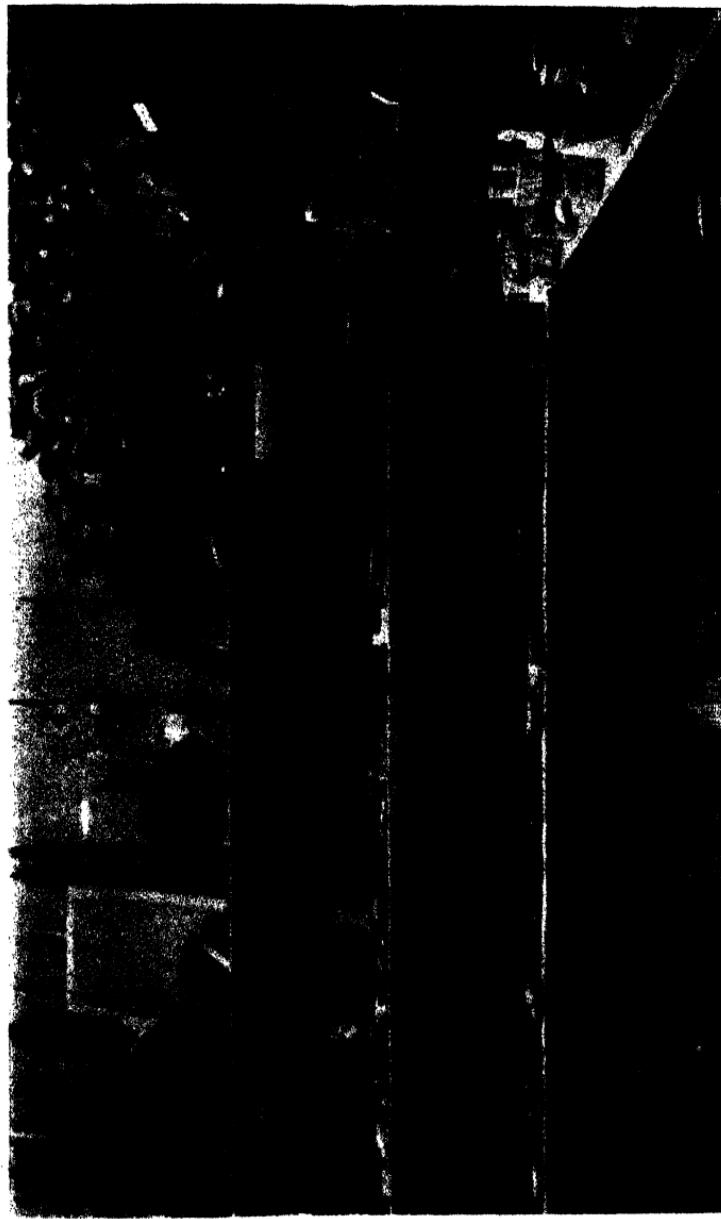
In 1898 Mr. Barber went to India in charge of the Botanical Department of Madras, and was succeeded by Mr P. Groom, who has since taught both Forest Botany and Entomology. Colonel G. F. Pearson, late Inspector-General of Forests in India, and for some years Director of the Studies of English Forest students at Nancy, was appointed one of the Board of Visitors of the College on the retirement of Sir Dietrich Brandis, who had held that post since the commencement of the Forestry Branch at Coopers Hill. Dr. Matthews also succeeded Mr. Church as Instructor in Organic Chemistry. Dr. Schlich was made a Fellow of the Royal Society in the same year.

In 1900 the entrance examination for admission to Coopers Hill of candidates for the Indian Forest Service was modified by dividing the subjects into two classes—

I.—Elementary Mathematics, English Composition, German, and Botany. These were made obligatory.

II.—The optional subjects were the Higher Mathematics, Latin, French, Greek, English History, Chemistry, and Heat, Physics, Physiography, and Geology.

Owing to this change candidates had to show a knowledge of Botany, but the important subjects of Chemistry and Physics were still left optional. The course at the College was also reduced to two years, and nine months assigned to practical Continental training in Forestry.



Corner of Forest Museum—Exhibits of Wood Specimens.

Chemistry and Heat were then added to the list of obligatory subjects for all Forest candidates for admission to the College, so that a certain knowledge of science was again ensured.

Since 1887 the following number of students have passed through the College up to the date of the closure of the Forest Branch, August 2nd, 1905:—

- 154 have been appointed Assistant Conservators
of Forests in India ;
9 others have obtained diplomas in Forestry ;
9 students are now doing practical work in
Germany, and will probably get diplo-
mas next July.

—
Total ... 172
—

Of these, twenty have obtained Fellowships at Coopers Hill ; of the nine who did not go to India two were declared medically unfit, three have received Forestry appointments in Native States in India, three in Cape Colony, one in Ceylon, and one in Siam. Besides these students, one from an Indian Native State and one from Cape Colony failed to obtain diplomas, and two others, non-resident, who attended only a part of the course, have obtained appointments in Cape Colony and Mauritius.

Of the nine students now in Germany, one is intended for service in the Soudan, and the others will, if qualified, go to India. It is probable that one of them, Mr. Mercer Adams, will be a Fellow of Coopers Hill, the last Forester to attain this honour. Fourteen students have also completed their first year at Coopers Hill and will go to Oxford, where they have been admitted to various Colleges, and to Germany for the remainder of their course; two of these are intended for service in the Malay States.

We have to regret the death, on duty, of six of the Coopers Hill Forest men who went to India, and their names are recorded in memorial tablets in the College Chapel. One of these, Mr. Abbey, was a Fellow of Coopers Hill. Mr. Grenfell has retired from the Indian Service, and is now employed in the Transvaal Forest

Service, while Mr. Hanson, who has also retired, is Instructor in Forestry at a school for woodmen in the Forest of Dean.

Much work besides that involved in the instruction of the students has been done by the Forestry Professors at Coopers Hill.

Coopers Hill as a Forest School is no more, but the men trained at the old College have already begun to make their mark, while somewhat of the old *esprit de corps* of the United College of Engineers, Telegraphists and Foresters will remain at Oxford. Let us hope that the Indian scientific services will continue to remember the old bond of union between them and will further good government in India by working in concert. It is also essential for the success of the Oxford College of Forestry that distinguished men, who have every prospect of rising to the highest posts in the Indian Forest Service, should be ready, as was Dr. Schlich, to resign a brilliant Indian position, in order to continue the work he is now starting at Oxford. None but the best of Indian Foresters should be entrusted with such a work.

NOTE ON THE DAMAGE DONE BY THE DROUGHT OF 1899-1900 IN THE PANCH MAHAL DIVISION.

BY R. S. PEARSON, I.F.S.

In the July 1903 *Indian Forester* a Note was given on this subject in which the damage was described and the measures proposed to be taken to minimise the evil were stated.

It was mentioned that, owing to the large number of dead and dying teak and other species standing in the forest, the permanent working plans had to be suspended for four years, ending 1905.

As laid down in the temporary working plan drawn up in 1901, for extracting these damaged trees, one-fourth of the whole forest was marked and felled each year. The teak were numbered and felled for sale, and from these enumerations can be judged the enormous damage wrought by the drought of 1899-1900.

The area worked over was 152,949 acres and the number of teak cut out was 2,782,700 over 9" girth and 1,415,500 under

9" girth, or a total of 4,198,200 trees. These figures speak for themselves in showing the amount of damage.

It is interesting to note the effect of the drought on the trees. The trees affected, soon after the failure of the monsoon, showed signs of becoming stag-headed. The damage then worked slowly down the stem and, finally, the whole portion of the tree above ground was completely dry. This took from two to three years; after that the roots showed signs of drying, and, finally, the whole tree system was completely dead. The fellings of the first two years produced excellent coppice, and the act of felling the dying trees, and so allowing vigorous coppice shoots to come up, caused new roots to form, thus for a time saving the root system. The fellings of the third year produced fair coppice, but not so good as that of the first two years' fellings. This was partly due to the stools having reached a more advanced stage in drying, and also to the very short rainfall in that year. The results of last season's fellings have not yet been carefully examined, but, provided some vitality is still left in the stools, the heavy rains of this monsoon should anyhow give a fair chance of a certain amount of good coppice being produced.

The result of these fellings has naturally much opened the forests, with the result that natural regeneration in fire-protected areas has been above normal, especially of such species as khair (*Acacia catechu*) and dhaura (*Anogeissus latifolia*), and teak to a less degree.

The following is a list of trees, giving their respective power to withstand drought as observed in this Division :—

I.—Species not found damaged by drought.—

Kosam	...	Schleichera trijuga.
Sissam	...	Dalbergia latifolia.
Aniar	...	Acacia leucophlæa.
Karanj	...	Pongamia glabra.
Palas	...	Butea frondosa.
Tamarind	...	Tamarindus indica.
Phasi	...	Dalbergia paniculata.
Bherda	...	Terminalia belerica.

Rohin	...	Soymida febrisfuga.
Banyan	...	Ficus bengalensis.
Pipal	...	Ficus religiosa.
Nirmali	...	Stychnos potatorum.
Bor ...	...	Zizyphus jujuba.
Al ...	...	Morinda exserta.
Simal	...	Bombax malabaricum.

II.—Trees slightly affected by drought.—

Very slightly damaged.	{ Amba Moka Mohin Kandol Gugal Kalam Haldarwa Ganeri	... Mangifera indica. ... Schrebera swietenoides. ... Odina wodier. ... Sterculia urens. ... Boswellia serrata. ... Stephogyne parvifolia. ... Adina cordifolia. ... Cochlospermum gossypium.
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In some places somewhat heavily damaged.	{ Khair Bia Tembru	... Acacia catechu. ... Pterocarpus marsupium ... Diospyros melanoxylon.
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II.—Species badly affected by drought.—

Very heavily damaged.	{ Teak Kakada Umbh Mowra	... Tectona grandis. ... Garuga pinnata. ... Saccopetalum tomentosum. ... Bassia latifolia.
Heavily damaged.	{ Bili... Dhaura Sadada Aola	... Ægle marmelos. ... Anogeissus latifolia. ... Terminalia tomentosa. ... Phyllanthus emblica.

THE MUTHODI TEAK PLANTATION OF 1903-04.

BY D. J. EVERE
FOREST RANGER, MYSORE STATE.

It might not be out of place, as an introduction, to give a general description of the Jagur Valley and the Baba Buden Mountains which "completely environ it," and which, according to Rice,

contain one of the highest peaks, Malainagiri, 6,317 feet above sea-level, "between the Himalaya and Nilagiri." Rice thus describes the Baba Buden Mountains—"the loftiest range on the Mysore tableland. The form of the chain is that of a horseshoe with the opening to the north-west. The northern arm commencing with the Hebbe Hill stretches eastwards without interruption for about 15 miles, whence, bending southwards, it presents to the east an unbroken wall of more than 20 miles. The southern arm is formed by the Baswan Gudda and Woddin Gudda ranges. The character of the chain is that of a stupendous ridge 6,000 feet above the level of the sea, and in some parts only a few yards wide at the summit, rising at intervals into loftier peaks. The summit of the hills consists of steep grassy slopes, well wooded in the ravines, through which flow perennial springs. The sides are densely clothed with forests, among which are numerous coffee plantations, as well as in the Jagur Valley, which is one stretch of forest as far as the eye can reach." The Jagur Valley lies beyond the right bank of the Bhadra river. Continuing, the same authority says of the Baba Budens—"projecting as it were like some Titanic bastion, they guard the approaches to the Malnaad or Highland region formed by the congeries of hills and mountains which intervene between the range and the ghauts on the west;" and of the Jagur Valley he further adds—"throughout the Jagur Valley is a continuous stretch of valuable forest, densely clothing the hillsides and giving shelter to much coffee cultivation. Sholas and hanging woods occupy every ravine and hollow of the Baba Budens. In these vast solitudes the habitations of man are few and far between. A single homestead, hidden amid the luxuriance of tropical vegetation, is often the only sign of his presence for many miles around. These vast wilds and solitudes, with scarcely a human habitation, were, until a few years ago, well stocked with every variety of game, from the elephant and bison downwards. The advance of the coffee planter has now forced back the savage denizens to remoter and more secluded spots." At the time Rice wrote (nearly 30 years ago) he says—"Roads there are none. No wheeled conveyance disturbed the peace of the well-nigh trackless

woods save where a space, annually cleared for the occasion, allowed the car of some popular god to be drawn a couple of hundred yards and back from his shrine in the depths of the forest. All the valuable produce of the country was, and to a great extent still is, transported on the backs of cattle, the rallying sounds from the belled leaders of the drove resounding far and wide." But, thanks to the Public Works Department, a local fund road has been since opened from Chikmugalur, the headquarters of the District Forest Officer, to Hebbe, the headquarters of the Jagur Valley Range Office, a distance of 32 miles. At Hebbe the Forest Department has constructed a palatial wooden structure for the accommodation of the Ranger and a remarkably pretty gothic mortar building for the accommodation of Inspecting Officers. Both buildings are situated close to and on the right bank of the Bhadra river.

It might interest your readers to know, on the authority of Rice, that the Baba Buden Mountain is the cradle of the coffee cultivation of Southern India. "The Range is called in the Hindu Pooranas Chandra Drona, but derives its present name from a Mahomedan saint who took up his residence on one of the southern slopes, and is stated to have reared coffee from seeds he had obtained at Mocha. A cave containing what the Mahomedans assert to be the tomb of Baba Buden, but the Hindus to be the throne of Dattraya, is a venerated place of pilgrimage for adherents of both creeds."

The Jagur Valley is considered to be the best wooded part of the Mysore Province. The growth is of a very mixed character, consisting of the following species: Teak, Matti (*Terminalia tomentosa*), Hoonal (*T. paniculata*), Nandi (*Lagerströmia microcarpa*), Bete (*Dalbergia latifolia*), Houné (*Pterocarpus Marsupium*), Cedrela Toona and *C. serrata*, Jamun (*Eugenia jambolana*), Dindiga (*Anogeissus latifolia*), Kakee (*Cassia fistula*), Jambe (*Xylia dolabri-formis*), Sagode (*Schleichera trijuga*), Halasu (*Artocarpus integrifolia*), Jalarie (*Shorea laccifera*), Sampege (*Michelia champaca*), Thadsal (*Grewia tiliæfolia*), Bende (*Hibiscus esculentis*), Kanagal (*Dillenia indica*), Bage (*Albizia lebbeck*), Bilwara (*A. odoratissima*), Banni (*Acacia ferruginea*), Honge (*Pongamia glabra*), Genasu

(*Stereospermum suaveolens*), the wild mango, Thupra (*Diospyros melanoxylon*), Jagalagauti (*D. montana*), Tani (*Terminalia belerica*); Burga (*Bombax malabaricum*), and other species too numerous to mention. The large bamboo (*Dendrocalamus strictus*) and the small kind (*Bambusa arundinacea*) are to be seen everywhere, and their feathery culms lend a pleasing feature to the landscape and help to break the monotony of the broad-leaved species. The sandal, the tree of the Mysore Forest Department, inasmuch as it brings in the most revenue, does not thrive in the dense forest of the Jagur Valley ; but where the growth is rather open and shrubby, it abounds. That the sandal does not rejoice in dense cover, is evident from the large quantity of dead wood found in these forests. This dead wood is collected by the Department and sold annually for thousands of rupees. The quantity of such wood collected in this Range during the last official year amounted to no less than 230 tons, and the contractor has engaged to collect 200 tons more during the current year.

The teak is not uniformly represented, but occurs only in patches ; and since it is the most valuable of the timber trees of the district, the Department is endeavouring by every means to encourage its growth.

The soil of the Jagur Valley is a very rich loam and the length and the girth of the boles of the trees, particularly Matti (*Terminalia tomentosa*), testify to its depth and extreme hygroscopicity. The valley comes in for a very fair share of the S.-W. monsoon ; and during the rainy months (June to the end of September) the ground is very soppy.

All the State forests of this Range, and they are particularly fine, are comprised within the Jagur Valley ; but I shall speak of only one of them—the Muthodi State Forest, and more particularly the south-west corner of it, where teak planting has been carried on since the year 1903.

The Muthodi State forest is nearly an island, having nallas on its north, west, south and nearly half of its east side. In extent it is nearly sixteen square miles. The Chikmagalur-Hebbe road runs more or less along the western boundary of the block,

entering it at the 6th furlong in the 21st mile and leaving it at the 7th furlong of the 27th mile. Constituting as it does a fraction of the Jagur Valley, the forest growth in the block is of a very varied kind, consisting largely of Matti (*Terminalia tomentosa*), Tani (*T. bellerica*), Hunal (*T. paniculata*), Nandi (*Lagerströmia microcarpa*), Sagode (*Schleichera trijuga*), Kanagal (*Vateria indica*), Bete (*Dalbergia latifolia*), Houne (*Pterocarpus Marsupium*), Thadsal (*Grewia tiliæfolia*), Jamun (*Eugenia jambolana*), Yattaga (*Adina cordifolia*), Keechaga (*Erythrina stricta*), Dindiga (*Anogeissus latifolia*), Kakee (*Cassia fistula*), Bilwara (*Albizia odoratissima*), and several other species of trees. The large and small bamboos abound throughout the forest. Teak is found only in patches here and there ; and it is with the object of increasing the stock of this valuable species that artificial planting has been started.

The Muthodi teak plantation is, as already stated, situated in the south-west corner of the forest, and not far from the confluence of the Somavahaini and Tadave nallas, the former of which forms the western and the latter the southern boundary of the area. The Chickmugalur-Hebbe road divides the area into two nearly equal parts. The left half has a gentle slope towards the east, while the right half is nearly level. The locality is admirably adapted for the purpose for which it was taken up, and for water convenience it would be impossible to find a better spot.

It was decided by the Conservator of Forests in Mysore in his Inspection Note of the Kadur District that "a commencement be made with 50 acres on the right bank of the Somavahaini in compartment 1." The Note lays down that "the entire area should be cleared of all tree growth and bamboos, except promising specimens of Teak, Houne (*Pterocarpus Marsupium*) and Bete (*Dalbergia latifolia*), in December or January, and burnt in April, after removing all saleable timber," and accordingly work was begun in December 1902, when the area prescribed was clear felled, except for a few Bete trees, which were left as seed bearers, and the débris burnt at the end of March 1903.

A nursery of one-quarter of an acre (10 guntas) extent was formed on the right bank of the Tadave halla. Prior to the breaking

up of the soil, a large quantity of brushwood was burnt on the spot and after the ground cooled it was dug to a depth of $1\frac{1}{2}$ feet and the clods well pulverised and mixed with the ash; beds of 2 feet width and of convenient length were then laid out, and 10 pallas of seed sown in them, the seed having first been soaked in liquid cowdung for three days. (The seed was obtained from the Lakwalli Forest.) With the object of forcing germination, since teak is so tardy in the matter, the nursery beds were covered with a layer of straw and copiously watered morning and evening.

Seedlings which attained a height of 3 inches were pricked out of the nursery beds and basketted and allowed to remain in the nursery till they attained a height of 6 inches. In this way 6,500 seedlings were treated, and they were chiefly utilised to replace casualties during the months of September and October 1903. The remaining seedlings were allowed to stand in the seed beds till they attained a height of 6 inches, when they were pricked out and transplanted into the area in $1\frac{1}{2}$ feet cube pits at distances of 8 feet apart. This work was conducted during July, August and September 1903.

During the rainy season, and until the end of January, it is well-nigh impossible to enter the forests of the Jagur Valley, and in fact any Malhaad forest, owing to the luxuriant growth of a species of Liliaceæ which comes up as soon as the rains set in and holds the field till the hot weather lays it low, only to arise, Phoenix-like, during the next year. No matter how many fires may pass through the forest during the dry months of the year, with the advent of the rains the "Sulai Soppu," for that is the name of the lily, is sure to make its appearance. In forests rigidly fire protected the luxuriance the lily affects during the rainy season is awesome. It reigns supreme, and defies the natural regeneration of the forest trees by preventing the germination of seed, and suffocating any young seedlings which may have had the hardihood to come up a few months previously. The plantation proved no exception to the rest of the forest, and so the area had to be weeded in January 1904, and again in June 1904 and again last May.

Although it is only three years since the plants were put out a good many of them are now quite 20 feet in height and 6 inches in girth; but the average height is 8 feet and the average girth 3 inches.

During the official year 1904-05 a further extent of 50 acres was operated upon; but owing to the season having been an abnormally unfavourable one, the planting proved a failure, except in an extent of about 10 acres. However, the area was replanted during June and July last, and a further extent of 50 acres added.

The appended statement gives the total expenditure incurred on the plantation of 1903-04:—

Description of work.	No. or quantity.	Rate.	Amount.
		At per	Rs. a. p.
Felling over the jungle and burning over the débris	50 acres.	Rs. 21-8-0 acre.	1,075 8 0
Preparing a nursery 10 guntas in extent including watering charges for 35 days and other incidental charges, such as erecting a shelter, purchase of straw for seed beds, digging a drain around the nursery, transport of seed	...	...	99 4 9
Preparing bamboo pegs for aligning the area	34,000	Daily labour.	75 3 0
Weeding the area prior to aligning ...	8½ acres.	Do.	9 11 0
Aligning and pegging off ...	Not stated.	Do.	107 4 0
Digging pits	34,000	Do.	318 9 6
Filling do	34,000	Do.	117 7 6
Planting out	34,000 plants.	Do.	122 12 6
Baskets	6,500	Rs. 5-2-10 1,000	33 10 0
Filling baskets with earth and pricking out seedlings from nursery beds and basketting them	6,500	Daily labour.	19 6 6
Weeding in lines to ascertain casualties Replacing casualties	Not stated.	Do.	49 4 9
First weeding, January 1904 ...	49 acres.	Rs. 3 acre.	147 0 0
First pruning, April 1904 ...	49 do.	Daily labour.	23 3 0
Second weeding, January 1904 ...	21 do.	Rs. 3 acre.	63 0 0
Second pruning, June 1905 ...	49 do.	Daily labour.	5 0 0
Third weeding, May 1905 ...	49 do.	Rs. 3 acre.	147 0 0
Clearing compartment lines in the area and fire lines around it ...	...	Daily labour.	41 12 0
Total expenditure	...	...	2,465 11 6

SYLVICULTURAL NOTES ON HARDWICKIA BINATA.

BY OLD RANGER.

Referring to Mr. E. M. Crothers' "Sylvicultural Notes on *Hardwickia binata*" which appeared in the July issue of the *Indian Forester*, I venture to send you a note on my observations of the Anjan (*Hardwickia binata*) in the Buldana Forest Division of the Berar Circle, Central Provinces.

Distribution.—Here Anjan first occurs in the extreme north of the Division, along the outer lower slopes of the Satpuras, in the Ambabarwa Range.

It again appears in the Ajanta Ghats, where it occurs in the western portions of the Ghatborig Reserve, continues throughout the Geru-Matergaon Reserve, and extends into the eastern portions of the Amdari Reserve; these three reserves forming a more or less continuous chain of forests lying along the Ajanta Ghat Hills, which run from east to west through the centre of the Division, in a direction more or less parallel to the Satpuras and separated from them by a huge, flat, gently undulating and highly cultivated plain, some 40—50 miles wide and drained through its centre by the Purna River.

In the Ghat forests the extreme eastern and western limits of distribution are very well defined, few trees being found beyond a certain ridge or ravine in either case, which coincides to a marked degree with the mooram soil tracts, an extremely hard and dry clayey soil, highly impregnated with iron I believe.

To north and south, however, stray specimens of good growth often occur far out on the cultivated plains, which leads one to infer that possibly in ages past the Anjan forest extended right across this large intermediate plain.

Aspect appears to me to have little to do with distribution, all aspects being represented and equally favoured in the above tracts; a well-drained soil, mooram for preference, appears to be essential, and where these conditions exist trees of fine growth may often be found growing on the banks of streams.

Within the Anjan zones, wherever the soil is deep enough and contains a fair proportion of black cotton soil, with rather more

moisture than it is possible to obtain in a pure mooram soil, Anjan is found mixed with many other forest species, such as—

Khair (*Acacia catechu*)

Lendia (*Lagerströmia parviflora*)

Sadhra (*Terminalia tomentosa*)

Daura (*Anogeissus latifolia*)

Salai (*Boswellia serrata*)

and even teak, but as soon as ever we return to pure mooram soils Anjan appears growing either pure or has for an associate Salai only, presumably merely because no other species appear to be able to exist on such soils.

An enormous percentage of the stock in these Anjan forests is composed of old gnarled trees, *invariably* unsound ; young pole growth is rare, and occurs in ravines principally, and undoubtedly came into existence on the stoppage of indiscriminate hacking by Forest regulations.

Sapling growth is however even still rarer, and, strange as it may read, occurs principally in the vicinity of cultivation, and the best on temporarily abandoned cultivation.

This gnarled and unsound state of the older growth is undoubtedly due to generations of lopping, whereby fungi, injurious insects, fire, etc., etc., were rendered every aid and opportunity of multiplying their injurious effects. During times of scarcity of fodder Anjan leaves are much sought after, and in former days afforded practically the only fodder supply for starving cattle ; then, again, a useful fibre, yielded from the bark of young growth, *also* leads to heavy lopping.

REPRODUCTION FROM SEED.

A sporadic seeding of Anjan probably takes place every year, but regular seedlings I believe occur about every third to fifth year, when large tracts seed gregariously and generally *very* profusely.

The seed begins to fall early in May, and although heavy is, by means of the long wing with which it is provided, capable of being carried some distance by the wind, so that the whole of

the ground to leeward of a good seed bearer may be seen strewn thickly with seed.

With the first showers of the monsoon germination appears to take place, and the tap root, although the seed is lying on the surface fully exposed, manages to force its way into the hardest soils and immediately starts on its career *straight* downwards.

A week or so later the whole of the ground will be seen covered thickly with seedlings, so thickly that it is impossible to avoid trampling on hundreds on walking over the area.

My observations of the germination of Anjan seed have convinced me that very little moisture indeed is required to start germination, and so sensitive are the *very* young seedlings to excessive moisture that, if seed be sown in a pot containing leaf mould or rich soil, and this be allowed to get a little too damp, the thick fleshy cotyledons of the young seedlings are immediately attacked by rot, which extends downwards to the roots, and a whole pot of young seedlings may thus be destroyed in a single night.

The foregoing leads me to believe that the seed of the Anjan, owing to its great sensitiveness to moisture, is incapable of lying quiescent in the soil, unless that soil be *absolutely* dry, a condition which is hardly likely to continue for a twelve month in the driest of regions, outside a desert.

Therefore, unless the seed of the year had fallen just before Mr. Crothers made his fellings in February and March, I feel convinced that the supposed seedlings noticed by him after those fellings must really have existed before they were made and before the rains, that is, that they could not have been the result of the previous year's seed which had lain quiescent through one monsoon and germinated during the next one. With Anjan I find it often happens that in the case of seedlings or very young plants all growth above ground dies down or gets eaten off in the dry weather, but shoots up again on the burst of the monsoon, and these young 2—3-year-old plants are very often apt to be mistaken for seedlings of the year, until closer examination shows a thickened root stock and the scar or scars of the previous year's shoot or shoots.

Root system.—From the very first signs of germination the development of a very strong tap root becomes a noticeable feature. This tap root drills on straight downwards and apparently grows 5—6 times as fast as the young shoot above ground. I have found young seedlings, of 6—9 months' growth and only 3"—4" high, the possessors of tap roots 22"—28" long (actual measurements), the almost complete absence of side roots being very noticeable.

This enormous development of the tap root is maintained throughout the life of the tree, as may be seen by observing the root systems of Anjan growing on the edges of high banks or cliffs adjoining streams ; in such places, where washaways have occurred, enormous exposed tap roots may frequently be measured.

COPPICE AND POLLARD GROWTH.

In Berar Anjan does not coppice successfully ; the stools frequently produce numerous coppice shoots, but these never advance beyond a slender drooping stage, and gradually all die back.

It pollards very freely and most of the older growth is composed of pollards.

Timber.—Anjan timber is not prized in this province. It is an extremely heavy and hard wood but is only considered fit for supports, since its transverse strength is weak and it cannot therefore be used as cross beams.

The dark maroon heart wood is rarely if ever touched by insects, but the white sap wood soon gets riddled by weevils.

CORRESPONDENCE.

ARBORICULTURE IN THE UNITED PROVINCES.

Can any of your readers give me definite instances of avenues in the United Provinces or adjoining districts having been destroyed by insect pests ?

The point is raised on page 507 of your September issue in a review of the *Manual of Arboriculture* for these Provinces. I had

made some enquiries while preparing the Manual, and had been unable to find any authentic case in which avenues of mango, mahua, jamun or shisham had been injured in this way ; nor could I learn that the large mango and mahua groves, which are a feature of the Provinces, suffer severely from insects affecting the growth of the trees themselves. I therefore retained the existing recommendation to plant pure avenues, as there was no evidence to prove that the trees which form the bulk of our avenues ran any serious risk. But, of course, the evidence at my disposal is very incomplete ; and I shall be much obliged to any of your readers who may be in a position to supplement it.

I must not omit to acknowledge the cordial tone of your review.

CAWNPORE :

W. H. MORELAND.

27th October 1905.

We trust to be able to give Mr. Moreland some notes upon this subject ; but in the meanwhile we hope that any of our readers who may have been in the position to record personal observations will kindly place them at the disposal both of our correspondent and of our readers generally.—HON. ED.

A NEW METHOD OF FIRE PROTECTION.

The number for July last (page 419) contains a request for opinions on my old idea of forestalling incendiary villagers by a system of early and light firing. As the Honorary Editor put out my fires with a cold douche to begin with, and nobody else has responded, I crave permission to publish the following extract from a "Note on the Singhbhum Forests of Bengal," &c., dated 7th March 1902, by the late Inspector-General, Mr. H. C. Hill.

"Would it not be better to fire all the forest that can be got to burn early in January of each year, and so escape from the intensity of later fires ?"

Surely now I may hope for a little criticism, if only from the new school that pins its hopes of salvation to forest fires ?—F. G.

REVIEWS AND TRANSLATIONS.

FOREST ADMINISTRATION IN COORG, 1903-04.

A considerable addition was made during the year to the area of reserved forests in Coorg, consisting of some 107,209 acres comprising three large blocks of forests on the ghats. This area was taken from the forests of the province known as "reserved lands," *i.e.*, forests reserved under section 4. The balance of these forests will, we understand, be subsequently reserved.

The protected forests, which were fully explained in our last year's review, have remained without alteration. The total area of forests under the Department is 364,271 acres.

Satisfactory progress was made in forest settlement work, 107,209 out of 207,082 acres being settled; 22,433 acres have been excluded and transferred to the Revenue Department, whilst 77,440 acres are now pending settlement.

No additions were made to the sanctioned working plans, nor was any revision of existing plans necessary. The plan for the sandalwood area has been suspended owing to the destruction caused by the "spike" disease. As regards preliminary working plan reports it is stated that work will begin next working season on such as are required for the very large areas of lately-constituted reserved forests on the ghats; for these forests, owing to the inaccessible nature of the country, it will at first be necessary to be content with preliminary plans for the more accessible, and valuable valleys.

Under offences there was an increase of 43 cases as against 20 in the previous year. The increase was chiefly under "grazing" and "other" offences. The former were principally in connection with the sandal plantations. It is hoped that steps which have recently been taken to complete the fencing of these plantations will reduce the number of cattle trespassing in them. Under the other head the increase refers to sandal destruction outside the

reserves, and considering the extent to which this valuable source of revenue is threatened by disease the greater attention paid to its general preservation is a satisfactory feature.

We alluded in our review of last year's report to the method of fire protection instituted by the present Divisional Officer; that it has resulted in a well merited success will be obvious from the fact that in 98 per cent of the area protected fire was kept out. The total cost of the protection came to Rs. 26.77 per square mile.

Sixty-one per cent of the reserves were open to grazing, the increase over last year being due to the inclusion of the ghat reserves in the present figures. All the protected forests and reserved lands were open to grazing.

The report states that it is a matter of regret that there is no diminution in the mortality of sandal trees and plants from "spike" disease. During the year 27,990 diseased plants were uprooted and destroyed in the Jainkal Range and 12,078 in the Cauvery Range, a total of 40,068, at a cost of Rs. 1,039, as against 36,000 during the preceding year. We read, however, with relief that the epidemic is still confined to the area infected when these operations were first commenced and has not extended. Fear is, however, expressed that, as the sandal-producing tract in Coorg is limited to a very narrow belt, about 10—15 miles wide along the northern half of the eastern border, and that the disease has now been raging from four to five years, it will be only a matter of a few years before its effects will begin to tell upon the revenue.

The extermination of the lautana plant from the reserved forests, a work which can only be carried out in the monsoon season owing to the fact that it is only at that time that the plant can be pulled up without leaving the stump and main root behind to propagate fresh shoots, was not undertaken owing to disease appearing amongst the elephants. This peculiar affection has been already alluded to as having appeared in Mysore. It was apparently a form of anthrax identified as *Hæmorrhagia septicæmia*. In the Coorg forests alone six wild elephants were found dead, besides numerous deer and pig, some bison and two panthers. The disease also spread to village cattle. One of the

departmental elephants caught the infection and died, the rest being removed from the forest.

The reproduction of sandal is said to have again been poor owing to the absence of rain in February and March, the moisture being apparently an essential to the life of the seedlings at this period. Forest Officers in Burma will probably read with considerable interest the following paragraph : "The writer's attention has been particularly directed to the effect of fire protection in a climate such as this, so eminently conducive to the growth of forest vegetation, upon the multiplication of the more valuable species in the forest, and he must record his unwilling conversion to that side of the controversy which has been running on for some years amongst Burma Forest Officers which maintains that successful fire protection tends to the suppression and consequent diminution of teak in forests under certain circumstances. It is doubtful whether the same should not be said, although to a less degree, of other important species of which *Pterocarpus marsupium* is one. The balance of advantages is no doubt turned again by the superiority of the timber which is grown under protection. Locally, the teak taungya system, which is worked in these forests more than adjusts all differences, but of the fact set forth there is not much doubt in the writer's mind."

The old system of sandal reproduction by dibbling out seed has, owing to the destruction of the seed and young seedlings by rats, squirrels and monkeys, been superseded by the planting out of six months old plants from nurseries. Only partial success in this method was met with during the year under report some 5,000 seedlings being put out. Work in connection with teak kumries (taungyas) was continued in North and South Coorg.

Almost the whole timber production of the reserved forests is exploited by means of selection fellings. The sandalwood is however, removed under unregulated fellings, contractors searching and bringing in dead trees and stumps, no other trees being removed. Minor produce is removed under a system of annual leases sold by auction.

The total sales of timber, excluding sandal, aggregated 85,444 cubic feet and realised Rs. 80,596. Of sandalwood 246 tons of rough wood was collected, there being on hand 90 tons of clean wood and 90 tons of rough. Altogether 250 tons of rough wood were converted, yielding 236 tons of clean wood. To hundred and nineteen tons of clean wood were disposed of for Rs. 1,02,733, or an average of Rs. 469, the highest value yet realised. The cost of collection and preparation amounted to Rs. 20-15-0 per ton.

The gross revenue realised was Rs. 2,24,575 as against Rs. 1,86,215 of the previous year, the expenditure being Rs. 88,273 as compared with Rs. 94,099 and surplus Rs. 1,36,302 as compared with Rs. 92,116. The whole of this increase was derived from sales of departmentally felled timber and from sandalwood. About Rs. 41,700 was derived from rosewood and ebony; which were sold for as much as Rs. 2 and Rs. 4 per cubic foot respectively. As regards sandalwood, there was an increase of over Rs. 18,000 owing to a greater demand.

An attempt was made at the collection and preparation of gum kino (*Pterocarpus marsupium*). Three hundred and thirty-five trees were tapped and 77 lbs. of dried kino were obtained and sent for analysis to the Reporter on Economic Products, Calcutta, the report on the analysis proving a favourable one.

Five new elephants were captured in pits. Of these three were serviceable animals (one tusker subsequently died of anthrax), the remaining two being calves.

CURRENT LITERATURE.

IN THE FOREST QUARTERLY for August (No. 3 of 1905) there are two able papers by Henry S. Graves on Volume Tables and Methods of Scaling Logs. B. E. Farnow, the Editor-in-Chief, reviews the two works on Forest Terminology which have recently appeared. The one is the well-known French-German Dictionary by Professor J. Gerschell, of which the 4th edition has already been noticed in these pages. The second is the Bulletin of "Terms used in

"Forestry and Logging" issued by the American Bureau of Forestry. As Mr. Fernow says, the first-named publication covers a wider field and has a different aim from the latter, namely, to record for dictionary use the terms employed in the three languages in Forestry and allied subjects; while the American publication* is a statement of the terminology which the Bureau of Forestry "will closely follow in all its work." It is therefore less inclusive but to the Americans of more direct interest. We are of opinion that it would be of great advantage were the compilation of an English Dictionary of Forestry terms taken in hand. At present we suffer from having a plethora of words meaning the same thing, often curious derivations from the French or German. It would probably be of advantage to come to some definite understanding with all English-speaking Foresters upon this subject. E. A. Sterling contributes a short paper on Forest Legislation in California.

The monthly *ALLGEMEINE FORST-U JAGDZEITUNG* publishes as a supplement the *Jahresbericht über Veröffentlichungen und wichtigere Ereignisse im Gebiete des Forstwesens, der Forstlichen zoologie, der Agrikulturchemie, der Meteorologie und der forstlichen Botanik* für das Jahr, 1904.† This is a most useful annual survey of forest literature. Taking in the whole world, it discusses all magazine literature of permanent interest and also records all book literature. Each chapter, of which there are nine, is prepared by an expert in the particular subject dealt with. No index is appended, but a summary index comprising the last ten years is under preparation.

In the *RECORDS OF THE GEOLOGICAL SURVEY OF INDIA* is a paper by Mr. J. Malcolm Maclaren on the Geology of Upper Assam. It is pointed out that the region is a great plain situated 320 to 500 feet above sea-level, and bounded on the north-west by the Eastern Himalaya and on the south-east by the Patkai ranges, while the head of the valley is closed in by the crystalline

* Bulletin No. 61, pp. 53, 8mo., U. S. Department of Agriculture, Bureau of Forestry.

† Dr. Karl Wimmenauer, Frankfort, 1905, Mk. 3, 60.

and metamorphic rocks of the Miju ranges. On the Patkai and Himalaya ranges upper tertiary sandstones occur at a considerable height, up to 6,000 feet indeed, but they have not been observed anywhere on the heights of Miju. Attention is drawn to the general uplifting and reversed faulting of the tertiary rocks on either side of the great plain, and to the deflection in the trend of the Patkai range where it abuts against that of Miju. These features are attributed to earth stresses during the formation of the mountains. Mr. Maclareen concludes that the Patkai and Himalaya, in their later growth at least, are of contemporaneous development, and that both are orographically and geologically distinct from the great meridional mountain-system of Upper Burma, Tibet, and Western China.

In the *REVUE DES EAUX ET FORETS* for October an account is given of the meeting of the first Congress held having for its object the protection and reafforesting of the mountainous tracts. The Congress met at Bordeaux on the 28th and 29th of July under the presidency of the Minister of Agriculture, the Minister of Public Works being also represented, as were also the French Alpine Club, the Touring Club, the Geographical Societies of Paris and Bordeaux, the Society of Physical and Natural Science, the National Society for the Encouragement of Agriculture and other Agricultural Societies. The object of the Congress was to draw attention to the enormous importance, to agriculture in all its forms, to the maintenance of the water-supply for the requirements of the people, to the upkeep of roads and other communications, of reafforesting or keeping under forest the mountainous tracts in France. A number of resolutions upon this important subject were adopted.

BULLETIN NO. 53 of the DEPARTMENT of AGRICULTURE, MADRAS, deals with the cultivation and curing of tobacco as followed near Dindigul, Madura District. In this Bulletin Mr. Benson, Deputy Director of Agriculture, considers the class of soil chosen for tobacco cultivation, and the method of preparing it, goats and sheep being penned upon it at night for a month or six weeks after the land has been ploughed up seven or eight times.

The manure thus obtained is exposed to the sun and rain and then ploughed in. The seed is then put in beds, the beds being merely parts of the field with little banks raised round the sides to retain the water. These are made near the well, the beds being flooded to a depth of half an inch or more. This cakes the surface, and but a limited number of the seeds germinate. The latter takes place in seven or eight days. About six or seven weeks after germination the seedlings begin to show their leaves, and when these latter are 3—4 inches long the seedlings are transplanted. The land before the transplants are put in is ploughed up and the channels flooded. The plants have to be kept weeded and watered, and some hoeing is done. The plants are topped when they are $2\frac{1}{2}$ —3 feet high and a few days before the bud appears. They have then been about two months in the field and carry from 9—12 leaves. The plants ripen in 90—100 days, and when a few spots have appeared on the lower leaves the plants are cut off close to the ground at about 5 p.m. They are then allowed to remain exposed to the night dew and at day-break are gathered up and bulked into small circular heaps two feet high, the stalks outwards. These heaps are covered with straw, and are not opened till the third evening after the harvest. The plants are then left on the ground for a short time, being subsequently hung up on horizontal poles with the stalks pressed close to one another. The leaves are cured in 15—20 days from the time of hanging up.

When the stems of the leaves have become thoroughly dry, although the stalks may still be green, the plants are taken down and bulked into square heaps two feet or more in height, the stalks being laid crosswise over one another. These bulks are opened and rebulked every two or three days. When a blackish colour appears on the leaf, the fermentation is finished, and the leaves are stripped off the stalk and tied up into bundles of 50 leaves, weighing $1\frac{1}{2}$ to 2 lbs. each, and baled. In many cases a mixture of jaggery and water is sprinkled on the leaves after the fermentation is over. The produce of one acre of tobacco cultivated in this manner ranges from 800 to 1,000 lbs.

SHIKAR, TRAVEL, AND NATURAL HISTORY NOTES.

THE NILGIRI GAME AND FISH PRESERVATION ASSOCIATION.

The Report of the Nilgiri Game and Fish Association for the year closing 30th June 1905 contains much of interest to that ever-increasing class of sportsmen who have come to the conclusion that the time has arrived when, both in the interests of sport itself and in those of the game whose existence depends upon it, it behoves all true sportsmen to bestir themselves with the object of obtaining true and effectual game preservation laws, coupled with proper close seasons for each class of game and sanctuaries of efficient size.

The introduction of the necessary legislative measures rests with the Government or, we should say, Governments of the country, since the protection of the game in the numerous Native States is equally important and is in most cases entirely in the hands of their rulers. On the other hand, the determination of the correct close seasons for the various classes of game and the formation of sanctuaries depends to a great extent upon the sportsmen of the country; and their voices on these matters should carry considerable weight, for on their observations alone can correct opinions be formed.

It is obviously absurd to, e.g., have one close season of the same periods and duration for the deer family all over the country, since the climatic conditions are so different in different parts of this great continent. Equally absurd is it to prescribe, as has been done often, one and the same close season for, we will say, the sambhar and spotted deer of any particular locality. Many sportsmen must be well aware that in the middle of the shooting season in the north of India the spotted stags are often in velvet; in other words, from a sportsman's point of view they are closed to shooting, whatever the rules on the subject may prescribe. It

follows therefore that by recording their observations made in the forest, &c., as to pairing, period of gestation, time of appearance of young, &c., and making them known, sportsmen may do much to enable the correct close season for each class of game to be definitely laid down. On the subject of the formation of sanctuaries for game in much shot over areas the sportsman can also assist the local authorities by carefully recording his impressions on the abundance or otherwise of the game as compared with previous years during which he has shot in the same localities.

The game laws of the country are now under revision, and during the year the Committee of the Nilgiri Association were able to discuss the proposed new laws at length and to forward their recommendations to the Government of India. We feel confident that these recommendations will be found to embody many suggestions valuable alike to the Government of India and to the interests of the sporting public.

During the year the Association altered the period for which the annual ticket is current to a year commencing on September 16th. A visitor who comes up to fish in the spring and early summer is thus able to take out one instead of two separate licenses as previously.

The area of forest and stream over which the Association holds sway is under the Forest Act and the Nilgiri Game Rules, prosecutions taking place under the one or the other. Fourteen cases were prosecuted during the year, of which eight were taken into Court and convictions obtained in seven, one pending at the close of the year. The rest were compounded. In four of these latter European sportsmen were the offenders, the offence compounded being the shooting of undersized sambhar heads. A fine of Rs. 80 was imposed in Court on four natives accused of killing a sambhar hind. This is the kind of protection which is required throughout the country, and we trust that there will shortly be more Nilgiri Game Associations in India.

A considerable amount of vermin destruction was undertaken, a total of 240 head, including Wild Dogs (4), and Cats (65), Red and Grey Mongooses (24), Orange-throated Martens (3),

Goshawks (1), Black Eagles (4), Crested Goshawks (1), Sparrowhawks (28), Laggar Falcon (9), Honey Buzzard (40), Pale Harriers (33), Marsh Harriers (9), Crow Pheasants (15), Otters (2), Crestless Hawk Eagles (9), and Montague Harriers (2).

On the subject of the increase of the game as a result of systematic protection the report states that, at all events on the plateau, large game is steadily increasing. The same cannot be said,— and this is scarcely to be wondered at,— of the small game round Ootacamund itself; the large number of license-holders are said to make a heavy demand on the available stock, especially the jungle fowl. In outlying parts the numbers of these birds are said to be satisfactory. The year was particularly good for snipe, but woodcock were not numerous.

In the matter of big game 63 sambhar stags were shot, the best head obtained measuring 42 inches, which is said to be the largest shot on the hills for the last 40 years. Ibex shooting was open, but with the proviso that not more than one *bond-fide* saddleback was to be shot by any one licensee. Thirteen saddlebacks were shot during the year; the Association are of opinion that the closing of ibex shooting on the Nilgiris for several seasons and the subsequent limiting of the number allowed to be shot by each licensee to one saddleback has had a good effect. The numbers of the herds are said to have considerably increased, especially on the Kundahs, and herds of 20 to 30 with numerous kids are by no means uncommon. Our remarks upon the subject of close seasons are peculiarly applicable to bison shooting in the Wynnaad; the report laconically remarks that "the close season as fixed at present makes bison shooting almost impossible in this locality." Antelope are said to be scarce, but spotted deer and jungle sheep (barking deer) are fairly numerous.

Jungle fowl and quail are believed to be on the increase in outlying parts of the plateau. An experiment was made, with a view to improving the stock of the former bird, of rearing 140 red jungle fowl at Snowdon. These were sent to Sheffield, but only eight in all were turned out into the forest, the mortality being very high. We do not quite agree with the writer of the report that the

experiment is of doubtful utility. If this particular bird will not do experiments should be continued with others.

The total bag of large animals shot and reported during the year was—Bison 1, Sambhar 63, Spotted Deer 9, Ibex (Saddle-backs) 13, Tiger 11, Panther 5, Bear 4. A number of jungle sheep and some four-horned antelope and blackbuck were also shot. The above bag is considered approximately correct ; but the complaint has still to be made that some sportsmen will not take the trouble to send in details of their bags. We would suggest for the consideration of the Committee that the Honorary Secretary be empowered to refuse to issue the annual license to licensees until they had returned a record of the big game shot on the previous license taken out.

EXTRACTS FROM OFFICIAL PAPERS.

THE FACE VALUE PERMIT SYSTEM IN MADRAS.

Forest work in India is of such a varied nature owing to the great differences in climate, configuration and modes of life and methods of thought of the people who inhabit the great continent that the rules laid down for the working of the forests of one province are often probably entirely antagonistic to the ideas and usages of the inhabitants of another, and therefore unworkable.

Some papers* of considerable interest have been recently issued by the Madras Government on the method of working the permit system in that Presidency, together with suggested alterations to be brought into force in the future. Whilst, we understand, these alterations are suitable to Madras, many of our readers will doubtless be struck with their entire inapplicability to their own part of the world.

Considering a change in the present permit system advisable the Board referred the matter to the Conservators. The replies of these latter, together with the Board's resolution, which received the sanction of Government, are detailed below.

* The Honorary Editor desires to express his acknowledgments to the Government of Fort St. George for copies of these Papers.

Mr. C.E. Brasier, Conservator, Central Circle, wrote as follows :—

In reply to Board's Forest Reference, No. 168, dated 3rd April 1905, I have the honour to give below the previous history of the introduction of the located fellings system.

In January 1895 (Board's Proceedings, Forest, No. 451, dated 29th September 1896), the Board's attention had been attracted to the existence in certain districts of what may be called the "unregulated permit system" under which applicants were permitted to go into the forests and fell a specified number of trees of certain classes wherever found. The Board then called for a report as to the tracts in which the objectionable system prevailed and for proposals for improved arrangements. The Conservator, Central Circle, reported that the system prevailed in its entirety in Cuddapah and Chingleput districts and, with certain restrictions, in the other districts (Conservator's letters printed in Board's Proceedings, Forests, No. 451, dated 29th September 1896). The Conservator, Southern Circle, reported that in no district in his circle did the system prevail, but it is evident from his reply that unrestricted fellings were and still are in force in that circle, though not of the particular kind defined in the reference.

2. At this stage Mr. Hooper, then Conservator, Northern Circle, addressed the Board on 2nd October 1895 (Board's Proceedings, Forest, No. 207, dated 12th May 1896) deprecating the injudicious introduction of the coupe system on the ground that disastrous results were likely to follow in its train as it left the contractors a free hand, and as he had reason to believe that after such clear or almost clear fellings the reproduction of important species was practically *nil* in some instances. This was referred to the other Conservators for remarks. Mr. Popert agreed with Mr. Hooper in regard to the evil effects of ill-considered coupe fellings arranged without preliminary enquiries regarding the then condition of the forests, their proposed future treatment, the effect of the scheme on the neighbouring villages as to grazing, etc. Mr. Peet also, in concurring with Mr. Hooper, remarked that the permit system, with all its faults, would create less friction, would certainly satisfy the requirements of the public far better than an

ill-designed coupe system, and might even cause less injury to the forest. He enumerated some of the defects and dangers of haphazard attempts at working under the coupe system, *viz.* (1) the yield year after year was not uniform, (2) fellings were conducted without any idea as to their probable markets, and (3) the grazing, etc., requirements of the important villages were left out of consideration. The Board thereon, in the Proceedings quoted, concurred generally in the views of the Conservators and impressed on the Collectors the necessity of instituting adequate enquiries on the several points noted by Mr. Popert, before introducing the system of located fellings into the districts.

3. After thus disposing of this matter the Board took up the original subject for consideration, and observed in its Proceedings, Forest, No. 451, dated 29th September 1896, that the "unregulated permit system" was prevalent only to a small extent, and was gradually being replaced by more satisfactory arrangements, which would be improved and systematised as experience was gained. The Government thereon in its Order, Mis. No. 4447, Revenue, dated 10th November 1896, printed in Board's Proceedings, Forest, No. 521, dated 18th November 1896, laid down that efforts should be made to get rid of the permit system wherever it still prevailed.

4. From the latest annual reports from districts it is observed that the permit system and unregulated fellings do not exist in North Arcot, South Arcot, Tanjore, North Salem, and South Salem. In Cuddapah, with the exception of thirteen coupes which were under systematic working, the rest were worked under the permit system. In Nellore, except in areas dealt with in the Sriharikota and Casuarina plantations and certain minor working plans, the permit system was in force in the remaining areas. In Chingleput and Trichinopoly the permit system was in force almost throughout the districts. Generally wherever there are working plans framed, there are located fellings : in other places the permit system prevails.

5. As regards grass, permits were issued for its removal in Cuddapah, South Salem, and Trichinopoly. In other districts there was no demand or the grass was leased out.

6. It will be observed from the above that the Conservators in 1895, while approving of the well-considered plans for located fellings, deprecated haphazard measures in this direction. I fear however from the general forewarning tone of the Conservators' letters then issued that some District Forest Officers were only too glad of the excuse for doing nothing in this direction, and hence we find that in some districts of this circle, *viz.*, North Arcot, North and South Salem, South Arcot, and Tanjore, a great advance has been made by the abolition of the permit system as previously understood ; in other districts, *viz.*, Nellore, Cuddapah, Chingleput and Trichinopoly, little has been done in this direction. I am of opinion that located fellings can be introduced in all districts if proper measures are taken by the District Forest Officers towards this end. They will have to be combined with depots in towns in some localities, while in others contractors may be found to work the coupes, or, again, in other places a modified form of permit system, as the Government evidently foresees, will have to be introduced by placing the permit-issuing gumastahs in the forest to issue permits and supervise fellings. The latter is indeed usually the first step necessary where contractors cannot be got. Personally I am of opinion that the Government has taken very beneficial action in requiring that the measures to be taken towards further extending the system be reported, and it now rests with the District Forest Officers of the districts in which the system is not given yet widespread effect to introduce it without further delay, reporting to the Conservator the action they intend taking in order that he may give them advice and see that the possibility of the forest is not encroached upon. I would therefore advise that Collectors be requested to see that their District Forest Officers take action towards this end at the earliest possible date.

The following are Mr. A. W. Lushington, Conservator, Northern Circle's, remarks :—

With reference to Board's Proceedings, Forest Reference No. 168, dated 3rd April 1905, I have the honour to inform you that I quite agree that the permit system is most obnoxious ; that it

has but little to recommend it financially or politically, and has everything against it sylviculturally.

2. I notice in their Order No. 681, dated 17th April 1871—34 years ago—the Government remarks—

"The objectionable license and voucher system is still in force in the whole range of country with which the Forest Department have any concern. The Government desire that it shall be the constant effort of the Conservator and his deputies to extend the depot and periodical auction system as much as possible, and to put a speedy end to the license and voucher system, which is fraught with facilities for fraud and oppression."

3. I am of opinion that this sums up the case most clearly, and have pointed out more than once how the words of Government in the ultimate sentence are being fulfilled. Of course until the Act was passed and settlement completed it was difficult to put a stop to the system.

4. I am at present in communication with the Collectors of the different districts to see how and to what extent the abolition of the permit system can be effected : and I am glad to be able to inform the Board that in West Kurnool a great stride has been taken to this end, Mr. Wood having made an excellent commencement of departmental fuel and bamboo felling combined with the stopping of permits. I have requested the Collector to let the Board know what is being done in this respect.

5. In some districts there is still a desire to retain the permit system ; but I regret to report that it is chiefly in those districts where protection is at its worst. In some districts the officers are anxious to put a stop to it, but they seem to fear that the necessary establishment to carry out located fellings would not be sanctioned ; and in a very large number of instances they express the opinion that the existing type of range officer would never carry out the alteration satisfactorily. There is not the slightest doubt but that to have it properly effected we must have a better class of man than we have at present, and this is a point that is now under consideration between the various Collectors and myself with a view to addressing the Board on the

subject. The majority of range officers, or, at all events, of the inferior type of range officers, are, for obvious reasons, against the change, and one question is whether we shall not have to clean out the Augean stable.

6. The alteration to be effective must be undertaken on a large scale ; the expenditure will of course be great, but the gain financially and sylviculturally will be enormous. The question is whether a very large outlay would be sanctioned. If this is answered in the affirmative, I will address the Collectors with a view to having the whole scheme everywhere put on a proper basis.

Mr. Gass wrote—

I have the honour to inform you that the value of the recommendation made by Government is fully recognised, and efforts are being made to restrict removals to selected localities in the limited number of places in this circle in which permits are being issued. The opening of depots for the sale of wood for domestic purposes and agricultural implements is being gradually extended, and as the supplies to these depots are made departmentally the necessity for the issue of permits is largely reduced.

Where the employment of permit-issuing officers is still required the necessity for locating them in or near the forests is being urged.

Board's Resolution—Forest, No. 161, dated 1st August 1905.

Everybody is aware of the objections to the unregulated permit system and of the desirability of introducing departmental fellings and depots. But the change is not altogether an easy one, and is not to be carried out by a mere stroke of the pen. It would be easy to stop the permit system, but the introduction of departmental fellings implies working plans and men to carry them out. The Board recognises these difficulties and is prepared to make allowance for them.

2. At the same time, it is very desirable that the change should be made : Conservators and Collectors are evidently aware of the fact, and considerable progress has already been made by many District Forest Officers ; but the Board would impress on all

officers the need for still greater effort; a careful study of the needs and possibilities of their district is a necessary preliminary, but action should be taken as soon after as possible to supply those needs by suitable departmental arrangements, or by the nearest approach thereto, which the district organisation is capable of, *e.g.*, by the contract system, which obtains in Tinnevelly, or by the restricted permit system over limited areas, with gumasthas on the spot, to which Government refer, or by any other arrangement which District Forest Officers may consider suitable. Anything is better than the plain unvarnished "permit system" of old days.

3. The Board does not wish to suggest hasty and ill-considered action that will only result in failure—failure to benefit the forests, or failure to supply the public—but the Board would nevertheless request Collectors and Conservators to take the matter in hand at once, and consider what can be done; if more men are wanted on the temporary scale, the Board is ready to supply them.

4. Collectors will be requested to report in due course, through the Conservators, what advance they can make in their districts; and the Board will then submit a consolidated report on the matter to Government, in accordance with paragraph 2 of Government Order, No. 273, Revenue (Forest No. 59), dated 22nd March 1905.

MISCELLANEA.

KINO FROM CROTON TIGLIUM.

BY DAVID HOOPER, F. I. C., F. L. S.

A sample of "Gum of *Croton tiglium*" was presented to the Indian Museum in July last by the District Forest Officer, South Salem, Madras Presidency. The specimen was highly coloured for ordinary gum, and after examination was found to be an astringent secretion or kino. It was in brittle fragments of a black colour, with garnet-like edges, the taste was styptic, and it dissolved in water and rectified spirit with an acid reaction.

It had the following composition :—

Water	...	...	... 17·2
Tannin	...	...	... 65·0
Soluble non-tannins	...	...	... 6·8
Insoluble fibre	...	...	... 0·5
Ash...	...	...	.. 10·5
			<hr/>
			100·0

The aqueous solution gave the same reactions with ferric and ferrous salts, plumbic acetate, and mineral acids as Malabar kino. The amount of ash is rather large for kino, and is accounted for to some extent by the presence of earthy matter or sand.

The District Forest Officer, on being written to for further information on the yield of gum, and for a larger sample, replied that the small quantity (weighing about one ounce) had been collected at the base of about thirty trees, where it appeared to have exuded naturally. The tree known as *Croton tiglium*, Linn., is the "Katta-Kottai" of the Tamil people, and the seeds are the source of the croton oil of commerce. According to Sir Joseph Hooker's "Flora of British India" there are twenty seven indigenous species of croton, and a number of introduced species are grown for ornamental purposes, but, as far as can be ascertained, it does not

appear that a kino-like exudation from these plants has previously been recorded in India.

Writers on the subject of "Dragon's blood" have referred to species of croton as yielding a variety of this drug. In Central and South America there are at least four species yielding kino-like secretions known as "Dragons's blood," or "Sangre de drago." These have been identified as (1) *Croton draco*, Schldl., in Mexico and the Central American Republics; (2) *Croton erythræum*, Mart., in Brazil. The gum is known as "Pao de sangue de dragao," or Brazilian kino, and it is used externally and internally as a styptic; (3) *Croton hibiscifolium*, H.B.K.; and (4) *Croton polycarpum*, Benth., in Columbia (in the neighbourhood of Papayan), yield similar juices to that of the first named.

In L'Ecole de Pharmacie, Paris, there is a sample labelled by Prof. G. Planchon: "Croton Draco. Sangre de drago des Mexicains; c'est le kino des indigenes par l'usage identique recolte sur l'arbre qui croit abondant dans l'Etat de Vera Cruz; envoyé en 1854 par Schaffner en Mexique."

Prof. Ed. Schaer, of Strasburg, to whom I am indebted for information on the American crotons, published a list of kino-producing trees in *Berichten Deutsch. Pharm. Gesellschaft* (May 14th, 1901). One more species may now be added to his list.—*Pharmaceutical Journal*, October, 7th, 1905, p. 479.

INTEREST IN "SAPIUM" RUBBER IN THE FAR EAST.

The able Colombo journal, *The Times of Ceylon*, on August 12, printed a cablegram from its London office, referring to a report in the current issue of the *Indian Rubber World* (which had just then reached the correspondent) in regard to a new source of Amazon rubber, identified by the authorities quoted as *Sapium aucuparium*. The report mentioned the practice which has grown up in the Amazon region of mixing the latex of this tree with that of the *Hevea* species (the Para rubber tree proper), giving rise to questions as to what might result from a similar admixture of rubber latices in Ceylon, for example. In addition to printing the

London cablegram, *The Times of Ceylon* obtained a statement in regard to *Sapium* species from Mr. Herbert Wright, of the Ceylon Botanic Gardens, which is printed, together with an editorial comment on the whole subject.

Below are reproduced the cabled report and Mr. Herbert Wright's comments.

I.

[FROM "THE TIMES OF CEYLON," AUGUST 12.]

RUBBER FROM PARA.

MIXED WITH ANOTHER LATEX-YIELDING TREE.—FORTY PER CENT OF
"SAPIUM."—A SUGGESTION FOR CEYLON.

[COPYRIGHT—BY SUBMARINE TELEGRAPH.]

"TIMES OF CEYLON" OFFICE, 27, MINCING LANE,
LONDON, AUGUST 12, 8-20 A. M.

The American Consul in Para, in a report published in the *Indian Rubber World*, states that the great bulk of Para rubber is not pure, but mixed with the latex of *Sapium aucuparium*, up to probably 40 per cent.

Sapium aucuparium is a hardy and rapid growing tree. The seeds are small, and, although it would hardly be believed, it yields from 7 to 8 pounds yearly, but requires careful tapping.

The report expresses the opinion that it would be practicable to grow *Sapium aucuparium* in Ceylon if it was thought desirable.

II.

[FROM "THE TIMES OF CEYLON," AUGUST 16.]

"SAPIUM AUCUPARIUM" AND PARA RUBBER.

WILD AND CULTIVATED "SAPIUM" SPECIES IN CEYLON.—"SAPIUM
AUCUPARIUM" AT PERADENIYA

[WRITTEN FOR "THE TIMES OF CEYLON."]

Your letter re mixing Para rubber latex with the milk from *Sapium aucuparium* to hand. I regret being unable to give you

full information about the *Sapium* species and their possibilities in Ceylon, as I am replying to your queries while on inspection duty.

Grown here and how it may be identified.—The real *Sapium aucuparium* (Jacquin) is native to tropical America and has, under the name of *Sapium biglandulosum* (Mueller Arg.), been grown at Peradeniya for many years. It grows to a fairly large tree—40 feet high—and seeds freely. This species can be easily identified by the pair of opposite glands which occur at the base of the leaf blade. I enclose a specimen leaf showing these glands.

Tapping Experiments at Peradeniya.—The stem, branches, and fruit contain, at Peradeniya, large quantities of white latex, but my tapping experiments in 1902 gave unsatisfactory results, the latex from this species drying to a brittle resinous substance.

There will be no difficulty in supplying rubber planters with seeds or cuttings from the large trees at Peradeniya, but it will perhaps be better to wait and see what product we obtain by mixing the latex of this species with that of Para rubber. This experiment is now in hand.

It should be mentioned here that *Sapium Laurocerasum* (Desfontaines) is sometimes called *Sapium aucuparium* (Willdenow). This is not the real *Sapium aucuparium*, however, though the stem contains milk from which a poisonous birdlime is obtained.

Sapium species in Kalutara, Galle, etc.—Species of *Sapium* can be found growing wild in Ceylon and India, and also in Africa, and far-off China and Japan. One species in Ceylon, called by the Sinhalese "kiri-makula," and known botanically as *Sapium indicum* (Willdenow), is noted for the poisonous milky juice which it yields on tapping. It is an evergreen tree, its growth is rather slow, and it rarely exceeds 25 feet in height. We have no record of the weight of latex obtainable from it, and I should imagine the latter to be poor. This species is common in the moist low country, has been recorded from Kalutara and Galle, and may be recognised by its willow-like leaves, greenish yellow flowers, and abundance of milk in young branches and fruits.

Another species known to some botanists as *Sapium ingigne* (Royle), to the Tamils as "tilai," and Sinhalese as "tel-kadura," is to be found in the Trincomalee and Jaffna districts. This tree grows to a moderate size, has green flowers, and becomes leafless once a year. The stem contains a white milky substance, but not in large quantities.

Many years ago, about 1820, if my memory serves me well, *Sapium sebiferum* Roxburgh), commonly known as the "tallow tree" in China, was introduced to Peradeniya and Hakgala. The seeds are coated with "tallow," which is, according to Dr. Watt, used in place of animal tallow in China for the manufacture of candles, in soap-making, etc.

Mixing not recommended.—Though we do not know the possible yield or the quality of the latex from any of these species, I am inclined to doubt whether it would be any good attempting to mix the latex from species of *Sapium* with that from the introduced Para, Ceara, or *Castilloa* rubbers, now flourishing in Ceylon. Where the *Sapium* and *Hevea* species are growing wild and intermixed with one another, as in the forests of Brazil, there is an excuse for the coolly mixing the latex, but such conditions do not obtain in Ceylon.

In conclusion, it should be pointed out that the genus *Sapium* belongs to the same group of plants as Para and Ceara rubber and crotons.

HERBERT WRIGHT,
Acting Director, Royal Botanic Gardens.

III.

[FROM "THE TIMES OF CEYLON," AUGUST 19.]

[“SAPIUM” RUBBER GROWN IN GUIANA]

SIR.—I should have stated in my previous letter that seeds of the rubber-producing plant, *Sapium biglandulosum* or *Sapium aucuparium*, the "Touckpong" of British Guinea, were received from Mr. Jenman in May 1887. Mr. Jenman then stated that "the tree is quite hardy, of rapid growth, yields abundant milk, and the rubber is of high-class quality." Samples of the rubber

were shown at the Colonial and Indian Exhibition [London] in 1886, and were favourably reported on.—I have, etc.,

HERBERT WRIGHT,

August 17, 1905.

Acting Director, R. B. G.

(From the *Indian Rubber World*, Oct. 1, 1905.)

THE TIMBER RESOURCES OF LIBERIA.

The United States Consul-General Lyon, at Monrovia, Liberia, the Negro Republic in West Africa, says that Liberia's forestry resources offer an inviting field for a lucrative business in hardwoods. The virgin forests consist of woods of great commercial value, and there are ample water facilities for saw mills. There are two varieties of mahogany—red and grey; four varieties of oak—red, streaked, white, and whistmore; cedar, rose-wood, mangrove, burrwood, white and black gum, mulberry, brimstone wood, red peach, pepper wood, white mangrove, persimmon, iron wood, greasy peach, poplar, cherry, hickory, saffron, ebony, and many other woods common to the tropics. Some of these possess singular qualities. The greasy peach lasts indefinitely, and is proof against insect attacks. The heart of the mulberry is incased in a very thick sap, which succumbs readily to decay, but the heart itself, which is capable of the highest polish, is tough, and its durability is indefinite. The qualities of ebony and mahogany are well known. The African cedar is similar to the American pine, very light in colour, takes a beautiful polish, and is used for ceilings. The brimstone wood and the hickory, when seasoned, are so stubborn in their qualities as to defy penetration.

All that is lacking to develop what must be in the nature of events a permanent and profitable industry is sufficient capital to instal a first-class saw mill, and to guarantee its working expenses until the enterprise develops sufficiently to support itself and to pay its promoters. Some experiments in this direction have been made from time to time by Liberians of small capital, but they have failed, not from lack of patronage, but from insufficient capital, to meet the contingencies until the experiment could be put upon

a paying basis. There are no efficient saw mills operating now. A few months ago a second-hand mill was in operation at Junk River, and the local demand for sawn lumber was far beyond its capacity, but with the mysterious disappearance of the operator its activity has been impaired. Another enterprise is about to start under the auspices of the Thompson Mission, a religious organisation at Mount Coffee on the left bank of the St. Paul River, about 35 miles in the interior. A second-hand saw mill has been secured in the United States to further an idea of the Superintendent of the Mission, who purposed to build a Christian colony among his native converts.

There is an ever-increasing local demand for planks for construction purposes, but the present crude system of manufacturing them, in the absence of saw mills, is not only tedious to contractors, but highly expensive to builders. This expense and delay force the builder to import lumber which is by no means adapted to climatic conditions or to resist the attacks of destructive insects which are known to devour an ordinary house, constructed of foreign pine, in less than a year. Most of the lumber comes from the United States *via* England, Germany, or the Canary Islands, there being no direct communication, which increases the price. The Liberian Secretary of the Treasury, who is now erecting a residence, gave this difficulty as his reason for using lumber imported from the United States instead of native lumber, which is better in quality and durability. The following are the prices of foreign and native lumber per foot : Foreign—pitch pine, spruce, and white pine, and $\frac{3}{4}$ in. weatherboards, 6 cents ; Native—inch boards, 4 cents ; $\frac{3}{4}$ in. boards, 3 cents ; black gum, 5 cents. The native lumber is always rough, and by the time it is worked up to the grade of imported lumber, planed, with tongue, groove, etc., the price is considerably beyond that of the imported article.

In the absence of saw mills the method is to saw the logs into building planks on what is called a "saw pit." This pit is made of forks and arm poles about 8ft. high and 10ft. long. The log is hewed, squared, lined, and placed securely on the top of the pit.

It is then sawn by a whipsaw, handled by two men, one on the top of the log and the other on the ground under the log. Every inch of the work must be done by muscular force, and principally by the aborigines, whose idea of uniformity is imperfect. The planks thus manufactured are never of regular dimensions, so that the mechanic is always placed at a disadvantage in the production of high-class workmanship. It takes fully two months, sometimes longer, to turn out a thousand feet of lumber. This speed very often depends upon the temper of the workmen, and great delay is experienced in the completion of buildings. Builders who are compelled to employ this native system take from two to four years to erect an ordinary two-storied house. The scarcity of native skilled labour, and the consequent cost of preparing lumber, have a deterrent influence upon the average citizen with little means, and confines the building and improvement of houses to the few. The average man is compelled, from sheer necessity, to content himself with a building which falls below his desire. A Liberian planter of wide experience told me that he had been trying for more than eight months to get a sufficient quantity of lumber to erect his house, and notwithstanding additional expenses, by way of "dashes," to keep the aborigines at work before the rainy season sets in, he had only succeeded in getting 3,000 feet.

Corrugated iron is being imported into the Republic to meet this exigency. The preference for it is due to the fact that it stands the attacks of tropical insects better than imported lumber. It is used for "weatherboarding" as well as for covering. It is not, however, as well adapted to the climate as the native wood. It rusts quickly, and presents in this condition a somewhat ugly appearance unless kept constantly painted. In every instance the native wood is preferred.

Location.—Four saw mills could be installed advantageously—one operating at Cape Palmas, in Maryland County, near the Cavally, or some other river; one in Sinoe County, in the vicinity of the Sinoe River; another in Montserrado County, in the neighbourhood of the St. Paul, Junk, or Messurrado River; and the other at Cape Mount, along the shores of the lake or the banks of

the Mannoah River. The large number of rapids in these rivers could be used as hydraulic accumulators for operating engines. A prospector well versed in this kind of industry says: "It is perfectly safe and well within the mark to estimate that the daily output of the four mills would be 32 squared logs, 480 planks, and 256 blocks or spars." I am satisfied that his estimate is considerably below the capacity of any four mills of even ordinary grade.

Earnings.—Let us, on a conservative basis, estimate that the four mills would daily turn out 50 squared logs, 600 planks, and 325 blocks or spars. If the mills run 22 days in each calendar month the monthly output would be 1,100 squared logs, 13,200 planks, and 7,200 blocks or spars, an annual output of 13,200 squared logs 158,400 planks, and 86,400 blocks or spars. The price of a squared log in Liverpool is said to be \$34·56. Estimating this output at the prices now ruling in Liverpool gives the following as the annual earnings of the four mills: Square logs, \$456,192; planks, \$95,040; blocks or spars, \$93,312; total \$644,544.

ATHLETIC SPORTS AT THE FOREST SCHOOL DEHRA DUN.

The Sports of the Forest School took place on the 16th and 17th October, in brilliant weather, and were apparently much enjoyed by all concerned—both competitors and spectators. The Forest Officers were "At Home" on the 17th. The entries were numerous for the different events. The Secretary of the Athletic Club, J. E. C. Turner, deserves great credit for the very thorough way in which he worked out the details.

The 100 Yards was won in what, for untrained men, was very good time, a shade under 11 seconds. 1st Gibson, 2nd Ramaswami Aiyengar, 3rd Lushington.

The High Jump was also good—5 feet 4 inches. It was won by Lushington, with Gibson second and Ramaswami Aiyengar 3rd. This was very closely contested.

Again these three won the 120 Yards Hurdles in the order Gibson, Ramaswami Aiyengar, Lushington.

The Sack Scrimmage, which caused great amusement, brought out a great number of entries. It was won by Krishnaji Ramkrishna Date, with Rege second and Anant Govind Jog third.

The 220 Yards Flat Race was won by McCraken, with Ramaswami Aiyengar second and Reich third.

The Broad Jump was won fairly easily by Ramaswami Aiyengar (18 feet 3 inches), with Gibson second.

McCraken, Reich and Mitchell were respectively first, second and third in the Quarter Mile, which was run in exactly a minute, which was good.

Gibson threw the cricket ball 98 yards $1\frac{3}{4}$ feet—a very fair throw. Lushington was second.

Three-legged Race.—Sant Ram and Lakshmi Das got home first, followed by Reich and Shrigley.

There was a good field for the Half-Mile, which was won by Barkat Ram, followed by Nur Mahomed and Shrigley.

In the Mile also the starting line was filled with competitors to the full breadth of the course. The winners were Lakshmi Das, Jagan Nath and Sarveshwari Dutt.

The Obstacle Race was a very stiff course, and the water jump, which no one could possibly jump across and was very deep, drew a vast crowd of spectators, who much enjoyed the troubles of the runners. The winners were Gibson, Reich and Lakshmi Das.

Tennis Doubles, 1st prize: Reich and Ramayya, 2nd Turner and Jacob.

Tennis Singles: 1st Reich, 2nd Ramayya.

The Gymnastics were won easily by Anant Govind Jog, but a number of men entered pluckily; Lakshmi Das was second.

The Tug-of-War between Seniors and Juniors was won by the Juniors.

CEYLON RUBBER PLANTING.—A recent financial supplement of *The Times* contained a special article on Ceylon rubber, attention

being drawn particularly to the expected labour difficulty, and the need of more railway communication to deal with it. No doubt this matter will become of increasing importance; it has already become acute in the Straits Settlements, where a partial solution has been obtained by the importation of Javanese. At present most of the Ceylon labour is obtained from India, the Cingalese not having much reputation as workmen. In contradistinction to what obtains in Brazil, however, there is no climatic reason against the employment of European labour in Ceylon, and we may see labour largely augmented from this source in the future. Of course the labour question can never become of the same importance, with rubber as with tea and coffee. In the latter cases the produce is spoilt unless gathered at the right time, while with rubber the matter resolves itself merely into delay, the product improving rather than deteriorating by remaining in the tree. So far the canker pest seems the worst enemy the Ceylon planters apprehend, though I understand that loss from this source can be largely minimized by energetic and prompt measures at its first appearance.

THE FINLAND STATE FORESTS TIMBER SALES IN 1905.—The great timber auctions of the year in Finland proceeded during August. At these auctions in all 1,868,421 logs were offered, corresponding to a value of 7,996,163 marks 84 penni, and pulpwood and fuel to a value of 53,729 marks 30 penni. The bids varied between 12 marks 85 penni and 1 mark per log. The former bid was made by W. Rosenlew & Co. for a parcel of 11,260 logs from Orihvesi ranger's district. Most of the offers varied between 3 and 6 marks per log. Offers to a total amount of 1,412,111 logs, corresponding to a price of 7,220,062 marks 77 penni, and 39,000 c. m. fuel, &c., to a value of 38,970 marks were accepted. The year's timber sale from the State forests thus amounts to a value of 7,259,032 marks 78 penni—one of the largest, if not the largest, amounts the State forests have brought in in any year. Timber was offered for the first time this year from the enormous forest supplies out of Enare ranger's district.

LUMBERING IN EUROPE.—We understand from a Reuter's telegram in the *Petit Gironde* that the Ex-Empress Eugénie has recently sold the whole of her property at Solferino in the Landes to some local wood merchants. The price realised amounts to several million francs, and will, we believe, be paid at once. The property consists of an immense tract of forest, and the purchasers intend to commence the exploitation by extracting the resin from the trees. We trust it will prove possible for the Government to keep an eye on the future actions of the purchasers, for the destruction of such an area of forest would be an act of vandalism scarcely in keeping with European forestry traditions.

LAWN TENNIS BALLS.—For many years, as will be remembered, the bulk of the retail business was done by Messrs. Ayres. Then three years ago Messrs. Slazenger, their most formidable opponents, got the bulk of the tournament and club orders owing to some extent no doubt to the fact of their having a very prominent British player on their board. I understand that neither of these firms make the ball: they buy the balls from the rubber manufacturer and put the felt covering on. What difference there is between them seems to be largely a matter of the quality of the felt and of uniformity in size and weight. The ordinary player no doubt would not see any difference between one make and another, but the leading players are very discriminating, and a good deal of discussion has been going on lately with regard to the relative merits of the balls supplied by the two firms. Of course, I am referring only to the championship balls, sold at a shilling each; the cheaper balls have not a very large sale, and when bought, they are often made to do duty for a long time. In the principal tournaments large numbers of balls are used; for instance, in the final at Wimbledon between the American and British pairs for the Davis challenge cup six new balls were used in each of the five sets played, and no doubt a correspondingly large number were used in the previous international contest which did not come under my personal observation. The principal makers of lawn tennis balls are Messrs. Charles Macintosh

& Co., The Irwell and Eastern Rubber Co., and the new Eccles Rubber Works—the last firm, as will be remembered, using the Cox patent machine. Owing to the fact of the quality remaining the same while the price of rubber has advanced, the manufacturers have naturally had to advance their prices to the middlemen ; as, however, the retail prices have not been raised, it is a fair supposition that the profits of the latter have suffered a serious diminution. It may be therefore, though I speak without any actual knowledge, that a lower quality of felt covering has been used in order that the business may be maintained without loss. A difference between Ayres's and Slazenger's balls which I have not mentioned is the degree to which they are blown up : this difference is quite perceptible in some seasons, and players who have accustomed themselves to one make find a difficulty in showing to advantage with the other. Of course the middlemen are not limited to British balls ; the Germans have long had a cut in, though what the present position is with regard to their competition I am unable to say.

A GIANT SURREY TREE.—It is stated that the largest tree in the south of England is the King's oak at Tilford, which stands on the village green between two ancient bridges over the river Wey, and is some 30ft. in circumference at a height of 6ft. from the ground. It is mentioned in the charter of Waverley Abbey, the Cistercian monastery situated near by, but now in ruins, which gave its name to the works of Sir Walter Scott. The new motor omnibus service between Farnham and Haslemere crosses Tilford Common and passes close to this giant tree, which is still in vigorous growth.

THE FOREST LANDS OF GERMANY.—It must be a source of gratification for the people of Germany to learn that while other countries are being denuded of their timber, German land under forest increases rather than diminishes. According to statistics just published relating to the forest lands of the German Empire, 25·9 per cent of the entire land of the country is wooded as

against 25·7 per cent in 1885. The least wooded States and provinces are Schleswig-Holstein, Oldenburg, Hanover and East Prussia. Those with the most extensive forests are Saxe-Meiningen, Hasse-Nassau, and Baden, where over 40 per cent of the entire area is covered with wood. Pines and firs of various kinds are increasing, while all sorts of deciduous timber, such as oaks and beeches, are diminishing. Deciduous timber is largely confined to the south and west. German forestry employs nearly a quarter of a million of woodmen and officials, and the expense of maintaining them is more than repaid by the sales of timber.

BLACK COUNTRY'S NEW TREES.—The work of re planting the Black Country has been commenced by an association formed for the purpose, of which Sir Oliver Lodge, Principal of the Birmingham University, is President. Fifty acres have been secured near Bradley, one of the blackest parts of the Black Country. Upon a portion of the land the Wolverhampton and neighbouring authorities are building a small-pox hospital, and the remaining 42 acres are to be planted with young trees by the association, so that the best effect will be obtained. The association are negotiating for two other sites.

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